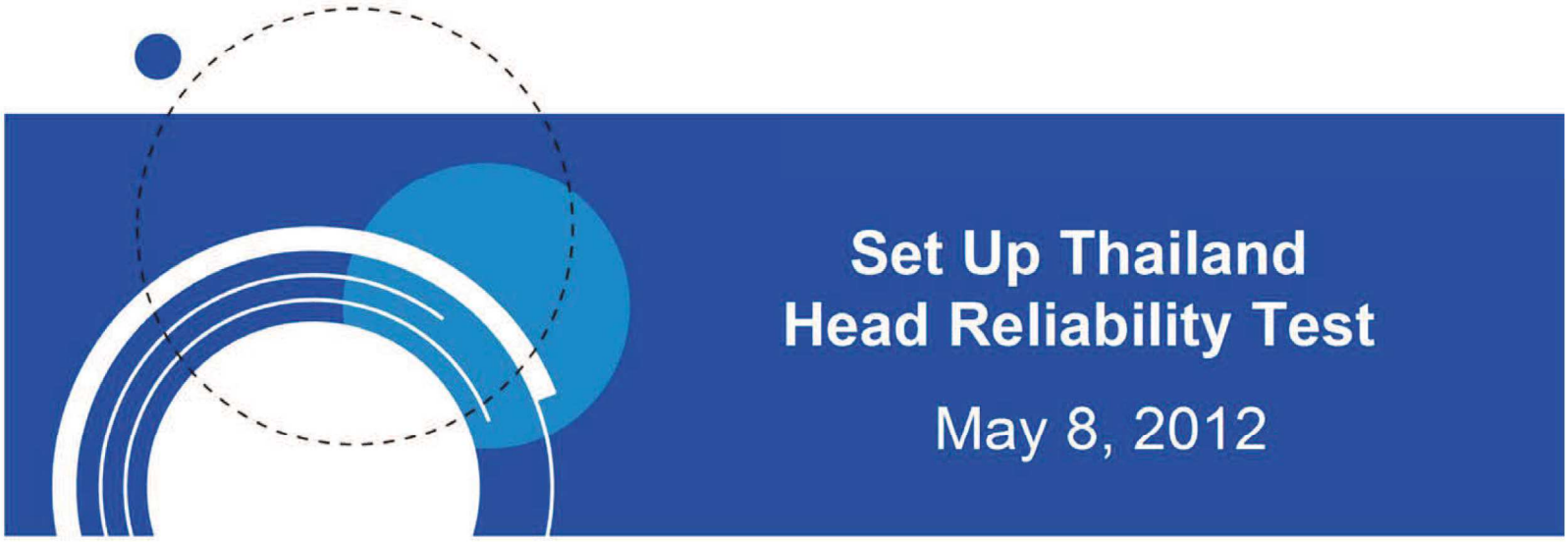
EXHIBIT 25

[REDACTED]



Set Up Thailand Head Reliability Test

May 8, 2012

Seagate

Set Up Thailand Head Electrical Reliability Test

Purpose: We would like to discuss how to set up Head Electrical Reliability Test in Thailand.

- [redacted]
- [redacted]
  - **Concerns**
    - Thailand has no test capability, need to have LCO Reliability test team develop the test script and support the set up.
    - Can perform only product that build HGSA and drive in Korat
  - **Cost**
    - Very high cost of additional space for all products from HSA to drive assembly capability in Korat and all supporting resources for [redacted]

Set Up Thailand HGSA Electrical Reliability Test

- [redacted]

[redacted]

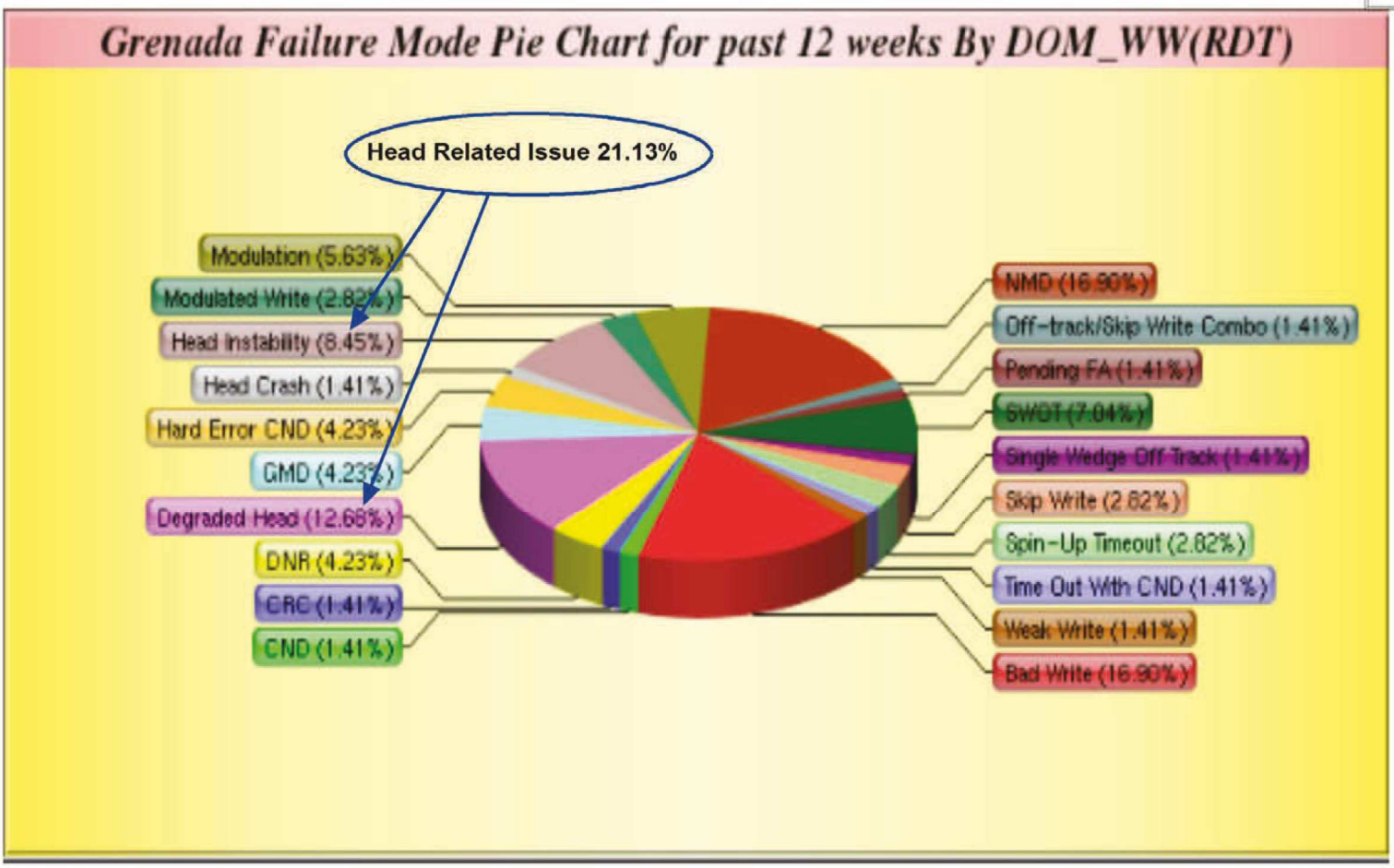
Set Up Thailand HGSA Electrical Reliability Test

- [redacted]
- [redacted]

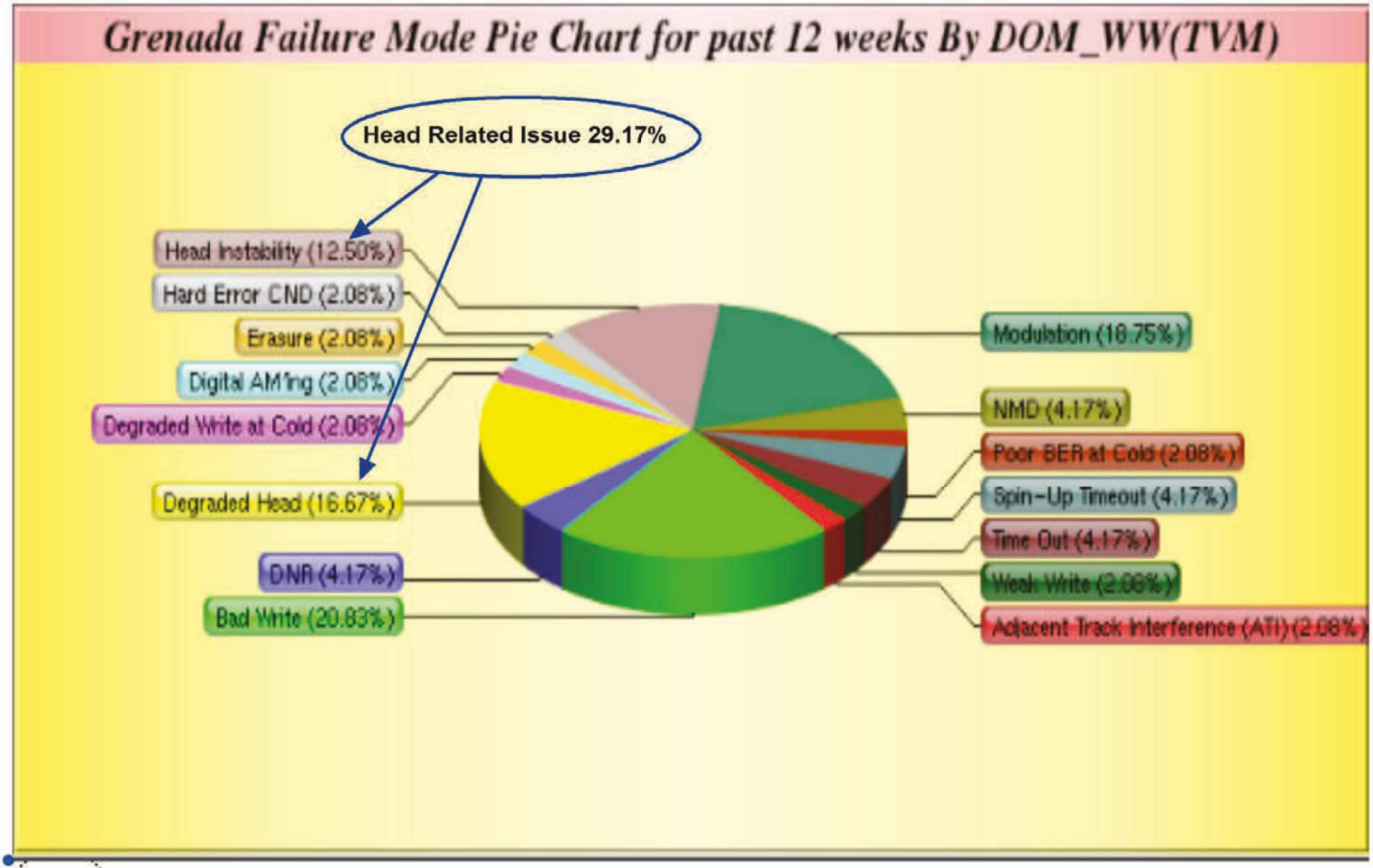
Thank You

Back Up

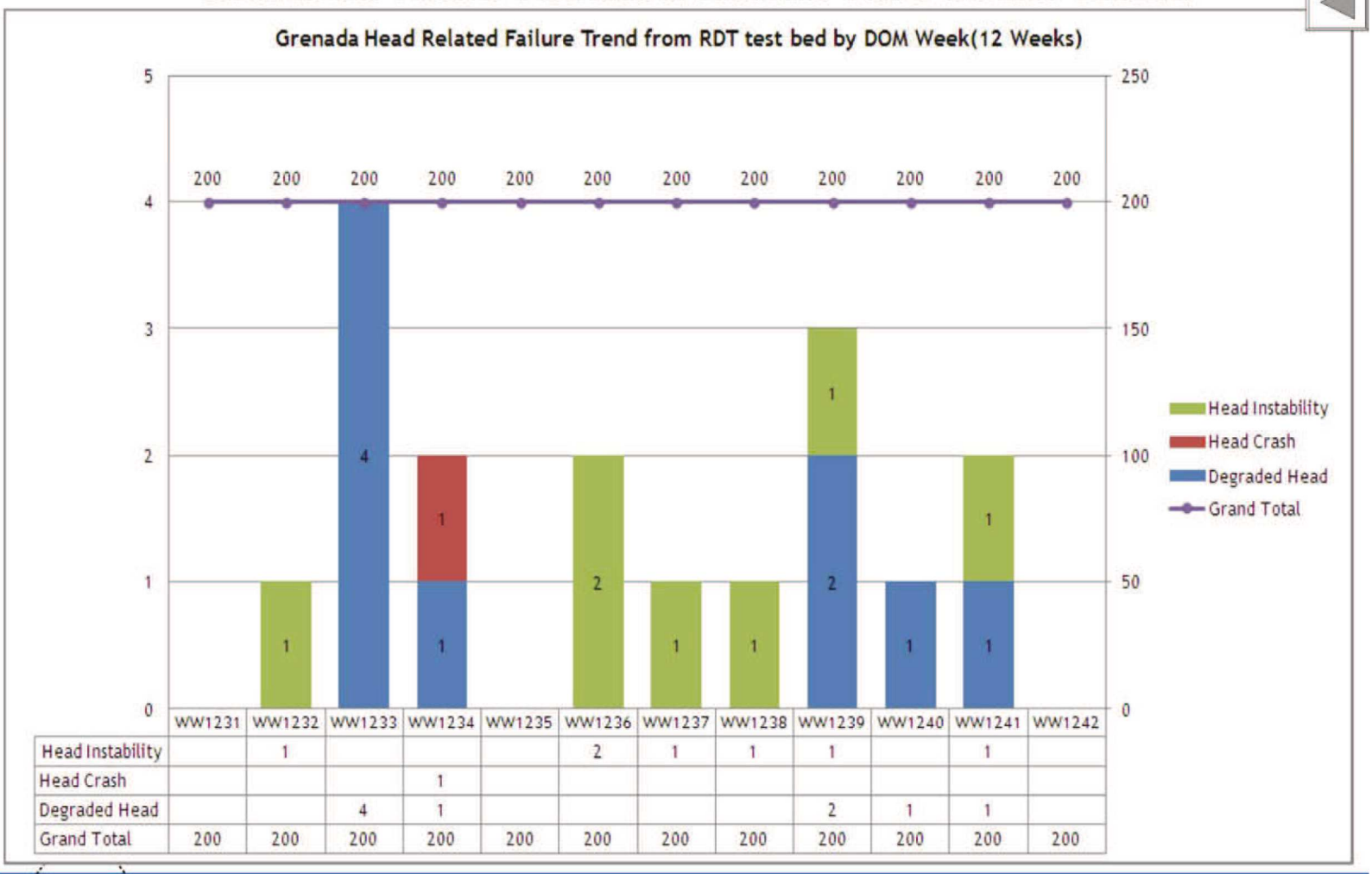
Grenada RDT Pie Chart



Grenada TVM Pie Chart



Grenada Head Related failure rate trend Chart



	WW1231	WW1232	WW1233	WW1234	WW1235	WW1236	WW1237	WW1238	WW1239	WW1240	WW1241	WW1242
Head Instability		1				2	1	1	1		1	
Head Crash				1								
Degraded Head			4	1					2	1	1	
Grand Total	200	200	200	200	200	200	200	200	200	200	200	200

Grenada ORT Failures Proposed Screen

SN	PFL#	Failing Head	Symptom	ttf (hrs)	HD_SN	Proposed Screening Location	Proposed Screen(s)	Yield Impact at Location	Cut-In Date (Tentative)
S1D0HH3Y	PFL-3305	1	Head Instability	53.7	AL50BIF0V1	ET	WIJITA(15 max)+SGRNH_F3(1700 max)	0.08%	Expect STTH cut-in on Feb 7
S1F04WRR	PFL-3299	5	Head Instability	62.6	AL50MFHJL0				
W1D0C9W4	PFL-3355	1	Head Instability	295.3	AL509CQBI1				
W1D09BNP	PFL-2954	1	Degraded Head	297.2	AL507PHKJ1	ET Drive CERT	TP_NLUMP(20 max) RAW_ERROR_RATE<2.1	0.07% ~1%	Expect STTH cut-in on Feb 7 Paper Sort + PCO17.4
W1D0CA1T	PFL-3388	1	Degraded Head	162.3	AL50EF73X1	ISI Drive CERT	SMAN_AMP_MAX > 1700 and SMANMAX_MAX_MAX > 2100 RAW_ERROR_RATE<2.1	0.39% ~1%	Expect PNG cut-in by Feb 9 Paper Sort + PCO17.4
W1E04V4X	PFL-3125	1	Degraded Head	151.5	AL50PNYTH1	ET Drive CERT	TP_PLUMP(-2min) + CTQ_NORM_NSE(0.13max) RAW_ERROR_RATE<2.1	0.38% ~1%	Expect STTH cut-in on Feb 7 Paper Sort + PCO17.4
Z1F0C5DK	PFL-3162	5	Degraded Head	411.8	AL506GQ9J1	ET Drive ADG	TP_PLUMP(-2min) + TCO_SLN (2.2 max) Possibly prevent reCERT for EC10504 along with other potential ECs	0.23% None	Expect STTH cut-in on Feb 7 Drive PE Team working Issue
Z1F0CM95	PFL-3094	2	Degraded Head	98.7	AL50GA1IT1	Drive CERT	MAX_JUMP>140 in P135_AGC_BASELINE_JUMP for ACTIVE_HEATER=W	~1%	Paper Sort + PCO17.4
Z1F0ELHT	PFL-3232	1	Degraded BER	56.0	AL50I2ASZ1	Drive CERT	DELTA_BURNISH_CHECK>-5 in P_AFH_DH_BURNISH_CHECK for ACTIVE_HEATER=R and STATE_NAME+AFH3 and TEST_TYPE=BURNISH	~0.19% head-level drive fallout	Paper Sort + PCO17.4

How Much Head Related Issue on ODT/ORT

ODT: 4 weeks MAV DPPM to ww39

- Airwalker: 69 DPPM (1/7172 root cause is CND/NTF and 1/10544, root cause is CND/NTF)
- Mantaray NL: 0 DPPM (1/6943 high noise and glitch instability, root cause is KAG)

ORT: AFR trend ww43

- Airwalker 1.30% (MTBF 670,813 hrs)
  - 9/1300 ww14-26 11% (1 unit) Head failure, root cause is PM/FL
  - 11/1500 ww27-43 18% (2 units) Head failure, FA in progress
- Compass 10.37%
  - 24/1200 ww27-39 79% (19 units) are Head failures, FA in progress
  - 5/400 ww40-43 FA in progress
- Muskie Plus 0.97%
  - 8/1200 ww15-26 25% (2 units) are Head failures, root cause is one KAG and the other is Base line switching
  - 12/1500 ww27-40 8% (1 unit) is Head failure, root cause is CND

Is There ORT In Penang And RHO ?

RHO: Helen Liang

- [redacted]

Penang: TeeYu Choo

- [redacted]

Is There ORT In TDK And Competitor ?

Competitor:

- They use ISI tester for Reliability test at HGA level with hot and ambient temp condition.

SAE / TDK: Juan Sifontes

- [redacted]

AMA Test Capability

[redacted]

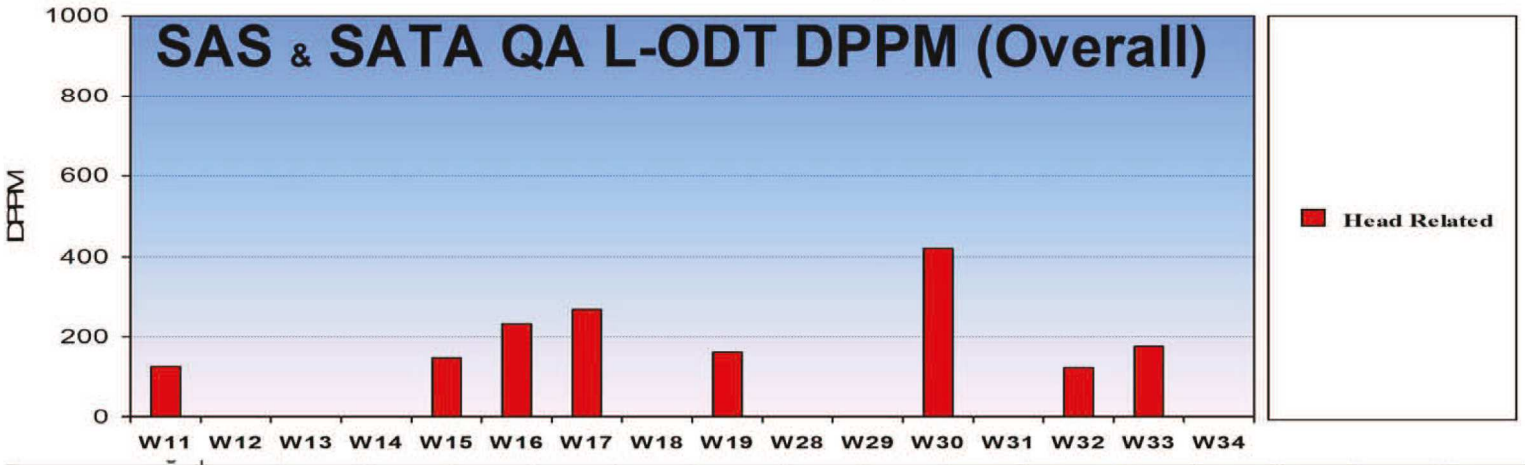
[redacted]

AMA Test Capability (Cont.)

[redacted]

[redacted]

MUSKIE PLUS L-ODT DPPM, Head Related

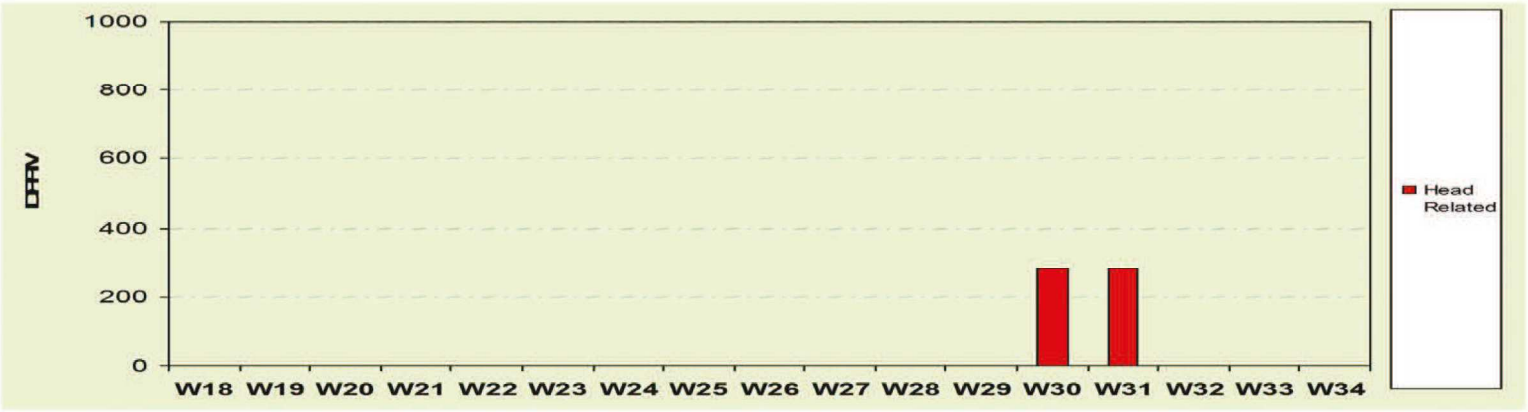


Failure Pareto	WW11	WW12	WW13	WW14	WW15	WW16	WW17	WW18	WW19	WW28	WW29	WW30	WW31	WW32	WW33	WW34
Head Related	125	0	0	0	146	232	267	0	160	0	0	422	0	122	175	0
Media Related	0	0	0	0	0	0	133	0	0	0	0	0	0	0	0	0
PCBA Related	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NMD	125	480	507	277	291	232	133	0	320	296	424	422	0	244	0	246
GMD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weak Write	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Skip Write	0	0	0	0	0	116	0	388	160	0	0	0	133	122	0	0
Write In MOD	125	96	0	0	146	116	0	0	160	148	0	141	0	122	0	0
Missed Defect	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Defect Syn Mark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Write In MOD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erasure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UnderFA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Quantity	7986	10410	5921	7215	6872	8620	7493	5152	6251	6759	7079	7113	7510	8211	5718	8122
Failure	3	6	3	2	4	6	4	2	5	3	3	7	1	5	1	2
ODT DPPM	376	576	507	277	582	696	534	388	800	444	424	984	133	609	175	246
4Weeks MAV ODT	363	392	441	444	493	524	530	569	618	444	434	620	492	535	490	304

Muskie PLUS Head Related Failures list

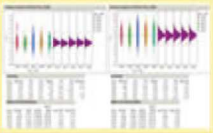
WW	Int	Serial #	P/N	EC	[redacted]	Type	Failure cause	hd_num	SBR#
11	SAS	Z1N0A03W	9YZ264-035	EC10398		NBR	Degraded Head -		SBQAXL
15	SAS	Z1P0MAVA	9YZ268-035	EC10507		NBP	Asymmetry Head -	hd 4	SBQAXL
16	SATA	Z1P0MZ67	9YZ168-001	EC13110		RWR	Digital AMing -	hd 7	SBQAXL
16	SAS	Z1N0F9GD	9YZ264-035	EC10005		NB	Baseline Noise -	hd 3	SBQAXL
17	SATA	Z1N0G0C7	9YZ164-035	EC13117		RW	Degraded Head -		SBQAXL
17	SATA	Z1P0Q6Z8	9YZ168-177	EC13110		NBR	Digital AMing -	hd 3	SBQAXL
19	SATA	Z1P0VC80	9YZ168-001	EC13114		RW	Digital AMing -	hd 5	SBQAXL
30	SAS	Z1P150W4	9YZ268-035	EC10507		RW	Asymmetry head -	hd 2	SBQAXL
30	SAS	Z1P12QB7	9YZ268-035	EC10010		RWR	Degraded head -	hd 1	SBQAXL
30	SAS	Z1P11FE6	9YZ268-035	EC10496		RWR	Degraded head -	hd 1	SBQAXL
32	SATA	Z1P138BB	9YZ168-035	EC13114		RW	Degraded head -	hd 6	SBQAXL
33	SATA	Z1N0V1X2	9YZ164-196	EC13116		RW	Asymmetry head		SBQAXL

AirWalker ODT DPPM, Head Related

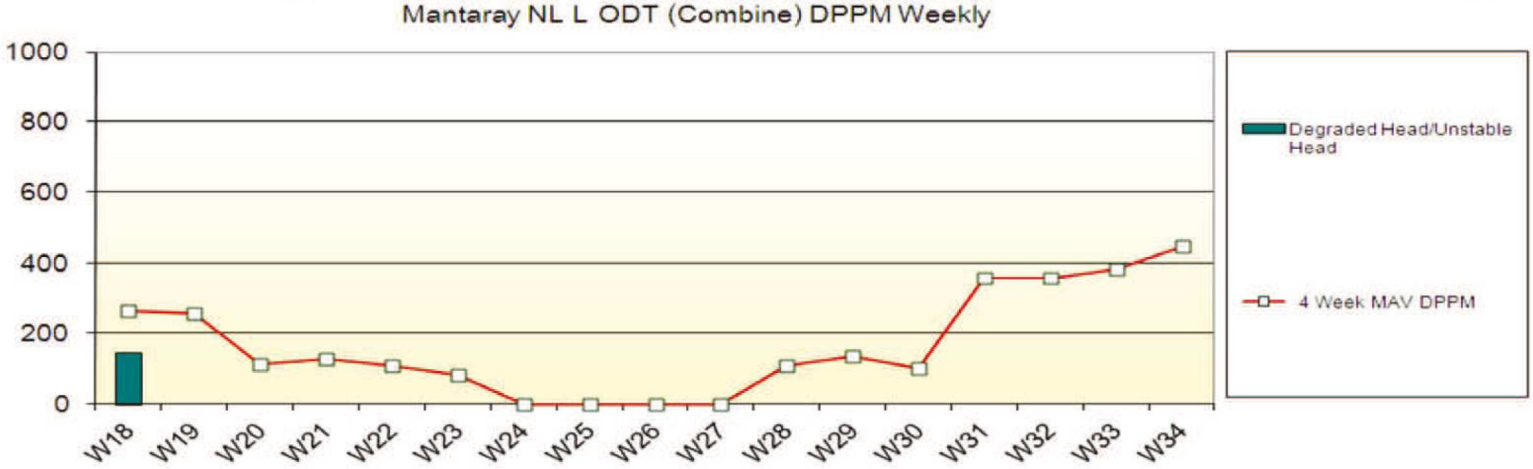


Overall	SAD	SAD	SAD	SAD	SAD	SAD	SAD	SAD	SAD	SAD	SAD	SAD	SAD	SAD	SAD	SAD	SAD	
Failure Pareto	WW18	WW19	WW20	WW21	WW22	WW23	WW24	WW25	WW26	WW27	WW28	WW29	WW30	WW31	WW32	WW33	WW34	4wks
Head Related	0	0	0	0	0	0	0	0	0	0	0	0	344	344	0	0	0	69
Media Related	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCBA Related	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NMD	0	344	0	0	0	0	0	344	0	688	344	0	0	344	0	1032	344	309
Weak Write	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Skip Write/ VDW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Contact Modulation/FHM	0	0	0	0	0	0	0	0	0	0	0	0	344	344	0	0	0	69
Abort/ Offtrack Write/SWOT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erasure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EAW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SDOD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DNR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GMD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Written in Modulation	0	0	0	0	0	0	0	0	0	0	0	344	0	0	344	0	0	69
Encroachment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Missed defect	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Track Spacing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NRRO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glist escape	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UnderFA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Quantity	13069	7919	2949	1328	2624	4882	3627	2643	0	3012	5041	7172	10544	11733	5717	8786	2906	29122
Failure	0	1	0	0	0	0	0	1	0	2	1	1	2	3	1	3	1	8
Total DPPM	0	126	0	0	0	0	0	378	0	664	198	139	190	256	175	342	344	275
4Weeks MAV	127	118	64	40	67	0	0	73	90	323	374	263	233	203	199	245	275	
Trigger Limit	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	

AirWalker Head Related Failures list

Work Week	Model S/No.	P/N	Run Type	Failure Mode	Time To Failure	FA Analyzis	Corrective Actions	Submission Date	Completion Date	Personnel in-charge
1230-1	9XG122HD	9RZ168-065	NBP	Degraded head .	7 h 47 m	**EFA :** Degraded head on hd 1 Failure analysis data : 1) From SM2, the drive has reported 39 G-list on surface 1. 2) Scope trace show poor signal on failing head . 3) BER by zone shows poor on head 1. 4) There are 34 TA count on failing surface. 5) MR resistance has been change 24 Ohms. ISI Result : The failed head Hd 1 shows slightly asymmetry on transfer curve and SMAN noise is slightly high Max noise Amp but not obvious. MFA : Degraded head **Head FA : NPF (Bark Jump)**	Pending CA	TBD	TBD	HAS
1231-1	9XF0XHJ4	9RZ264-039	RW	Degraded Head	19 h 58 m	**EFA :** Degraded head (reader) on head 3 Failure analysis data : 1) The drive failed for 01/18xx EC10496 Wt Rd Err Rate-Too Many Rec Errors@ Test 9: Fullpack Sequential Read. 2) From ODT log, The drive has been reported on LBA:0x28986720(681076512) to Cyl:0xB7D1(47057) Hd:0x5(5) Sec:0xC(12). 3) Scope trace shows sign of head instability on head 3. 4) Track profile and scope sector profile looks poor. 5) Poor BER by zone on surface 3. 6) Media plot look clean. 7) P135 Final contact shows normal as comparison between PRE2 and retest on bench. 8) ISI test can capture sign of instability head. MFA : Degraded head (reader) on head 3 **Head FA : Uniform DLC with scratch angle about (-7) degree on pole tips**	The following figure showed the whole distribution of BER (at fail proc) & BER spc id 1513 based on all of TAs failure since PCO=0127 onwards. Product team collected all of TAs failure almost 1K , and we will have delta b/w (spc id 513 - 333) < 1.4 around 8x heads , 0.1% approximately of total head qty 	WW35	WW36	Suwaree

Mantaray L-ODT DPPM, Head Related



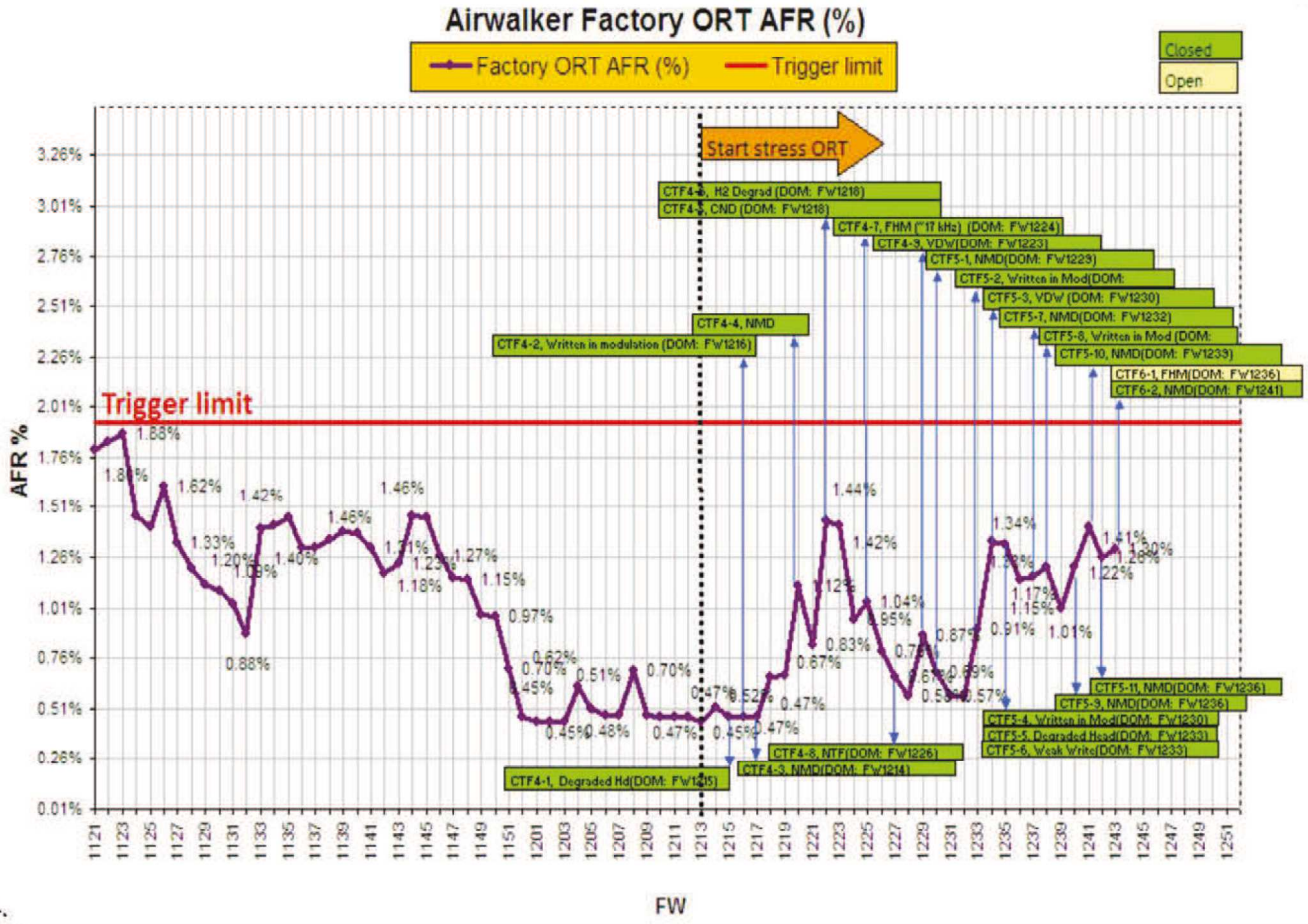
	Week	W18	W19	W20	W21	W22	W23	W24	W25	W26	W27	W28	W29	W30	W31	W32	W33	W34
HDD	Abort Write	0	0	0	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0
	Contact Modulation/FHM	0	0	0	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0
	NMD-PIS-DHDI/scratch	0	152	0	0	0	0	0	#DIV/0!	0	0	156	174	0	899	158	308	320
	DNR	0	0	0	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0
	Skip Write	0	0	154	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0
	Under FA	0	0	0	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0
Head	Asymmetry Head	0	0	0	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0
	Degraded Head/Unstable Head	144	0	0	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0
Media	RMD related - FA	0	0	0	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0
PCBA Related	PCBA Problem	0	0	0	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0
Motor Related	Motor Related	0	0	0	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0
	Qty Tested (Combined)	6943	6585	6474	3611	1654	260	82	0	523	2343	6425	5744	5309	7785	6335	6504	6241
	No. of Failures	1	1	1	0	0	0	0	0	0	0	1	1	0	7	1	2	2
	WK DPPM	144	152	154	0	0	0	0	#DIV/0!	0	0	156	174	0	899	158	308	320
	4 Week MAV DPPM	263	255	111	127	109	83	0	0	0	0	108	133	101	356	358	386	447

Mantaray Head Related Failures list

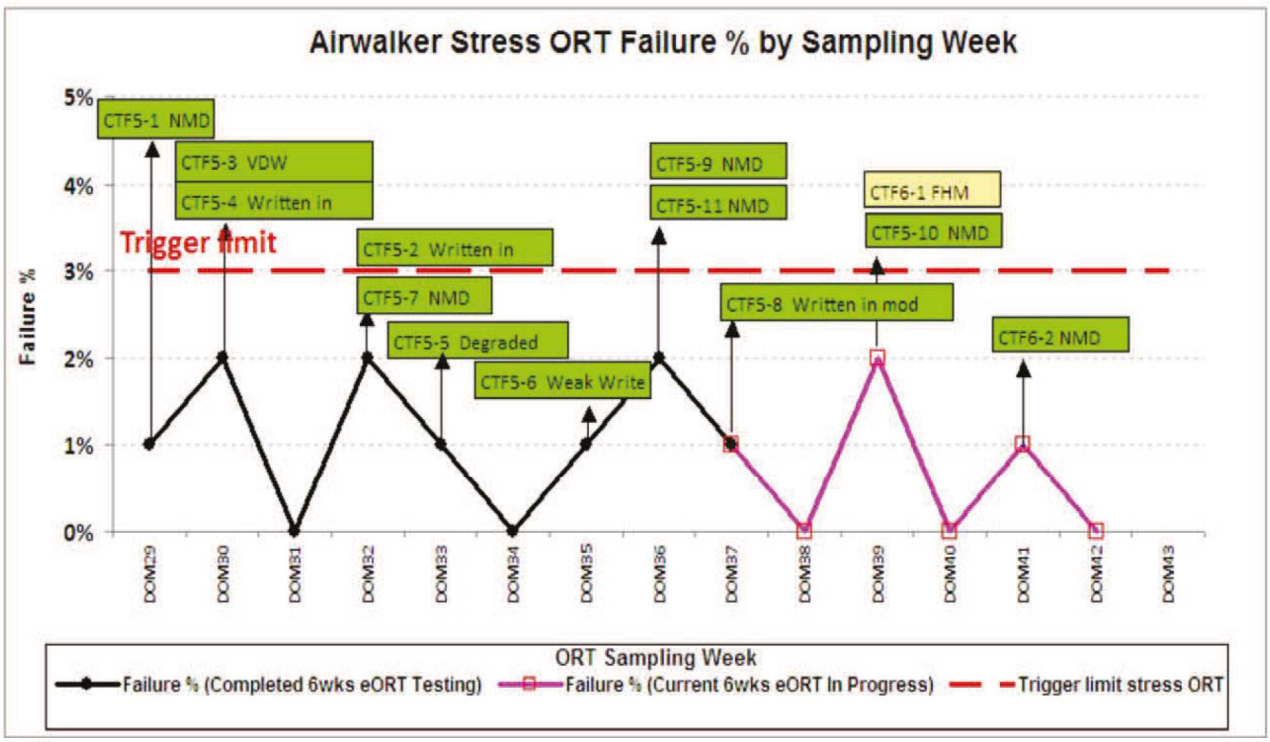
Work Week	Model S/No.	Failure Mode	Time To Failure	FA Analysis	Corrective Actions
1218_01	Z2918MPN	Degraded Head	29 h 47 m	**Degrade Head** 1) From Log CST2, the drive has been reported 1 defect count at LBA: F6C1CCD1(CHS : 2CE4F,8,10) Head 8, Zone 8. 2)Scope signal show noise on signal all Surface. The defect can be recovered after overwritten but low BER (BER = 1.6). 3) ISI test Shown high noise on head 8. 4) Defect map has not shown defect nearby failing location. 5) OTC normal Shown poor full track. MFA :No mechanical damage found inside the drive. Head FA : Head degraded; High noise & Glitch Instability	Pending CA from Product Engineer during studying to Optimize Spec of Max(UNVFYD_ERRS) @ P109_SUM_HD_ZONE;FNC2

Airwalker ORT AFR Trend Chart

WW1243 : AFR 1.30% (MTBF 670,813 hrs)



Airwalker ORT Failure % Chart by Sampling Week – (WW1242)

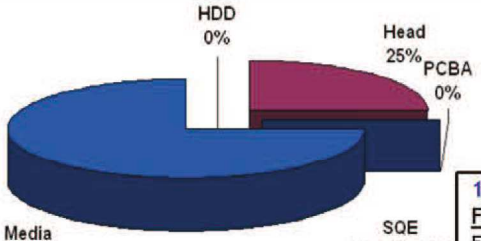


- DOM29 Onward test at Korat.

Airwalker ORT Failure Pareto

Airwalker ORT Failure Pareto (FY12Q2)

Sampling Week	Qty Tested	ORT TVM Failures		Stress ORT Failure
		Hot/Ambient Failures	Cold Failures	
FW1214 - FW1226	1,300	0	0	9
Total	1,300	0		9



1x buried defect
Further Action
Change out SS tank ---- RMO Cut in time -13 Oct

1x VDW - **Hot Failure**
Further Action
E-Coat action

2x **NMD - Hot Failure**
Further Action
Plate to cover holes at DSI m/c cut in time FW1222

1x **Degraded head- Hot Failure**
Further Action
HMRB9.6 for instability improvement. cutin date was postpone to WW23

1x FHM@17KHZ - **Hot Failure**
Further Action
E-Coat action

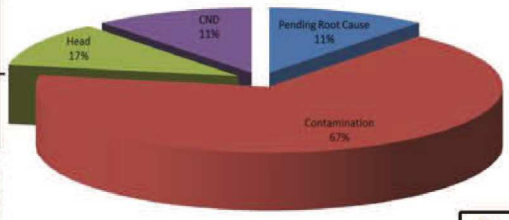
1x **Written in modulation- Hot Failure**
Further Action
Move DIP clean station to HAS process backend on 11/21

1x NTF- **Hot Failure**
Further Action

1x **CND- Hot Failure**
Further Action--Retest

Airwalker ORT Failure Pareto (FY12Q3-

Sampling Week	Qty Tested	ORT TVM Failures		Stress ORT Failure
		Hot/Ambient Failures	Cold Failures	
FW1227 - FW1241	1,500	0	0	11
Total	1,500	0		11



1x NMD - **Hot Failure**
Further Action
AKL MG Modification

1x VDW (Retest) - **Hot Failure**
Further Action
Retest Pass

1x Degraded Head (Retest) - **Hot Failure**
Further Action
Screen out

1x Weak Write (Retest) - **Hot Failure**
Further Action
E-Coat action

2x **Written in modulation - Hot Failure**
Further Action
Big Cleaning on 20-Feb.

4x **NMD - Hot Failure**
Further Action
Cleaning Clamp Pick up tool & Spacer load tool procedure.

1x **Written in modulation - Hot Failure**
Further Action
Screening out.

1x NMD - **Hot Failure**
Further Action

1x FHM - **Hot Failure**
Further Action

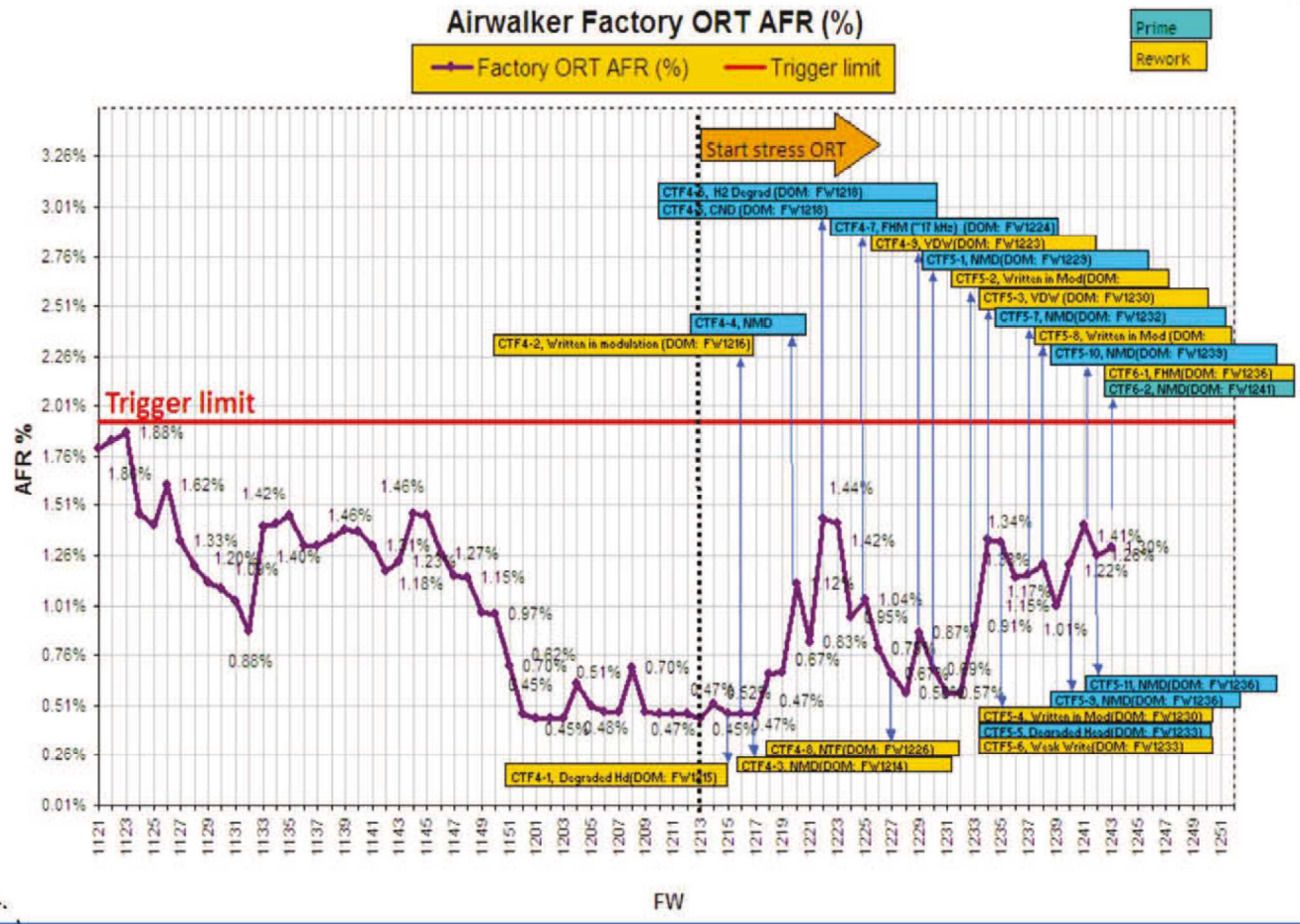
Seagate

Factory Quality Issues (ORT) – Airwalker Suzhou/Korat

Drive Info.	Failure Mode	FA Findings	Root Cause	CA	Remarks
Hot /Ambient Failures					
CTF6-1 9XF0ZNR9 03/1100 TTF: 539hrs. Drive loaded (FW1239)	FHM	FHM(~17 kHz) on surface 2, zone 0 **Failure analysis data :** FHM(~17 kHz) on surface 2, zone 0 Failure analysis data : 1)The drive was failed 03/11xx at Step 33 - Sequential Reads starting at MD. 2)From UDS log, the drive has been reported 1 failing location on LBA: 0x0001e5e88 Cylinder: 359 Head: 2 Sector: 1781. 3)Scope trace shows sign of FHM(~17 kHz) at failing location. 4)Signal can be recovered by overwrite. 5)No CERT mapped defect nearby failing location. 6)Retest T135 Final contact shows high delta CLR all heads as comparison to P135 at PRE2. **MFA status comment :** No anomalies found on retention torque reading during HSA tear down. On HSA inspection under low magnification, No contamination was observed on ABS and no mechanical defect found. From EFA report, scope signal show drop at failing location. Scope signal shown sign of modulation around failing location. From MFA finding, both of surfaces found lube ripple along failing track, OD, and ID zone. All of this potentially induced by contamination. By summary, root cause of drive failure was due to contamination. With evidence from both EFA and MFA, major cause was due to contamination.			Open

Airwalker ORT AFR Trend Chart

WW1242 : AFR 1.26% (MTBF 693,622 hrs)



Factory Quality Issues (ORT) – Airwalker Suzhou/Korat

Drive Info.	Failure Mode	FA Findings	Root Cause	CA	Remarks
		Hot /Ambient Failures			
CTF5-8 9XF103PS 0/0300 TTF: 22hrs. Drive loaded (FW1237)	Written in mod	**EFA** Written in modulation (3.18 kHz) on surface 3, zone 19 Failure analysis data : 1) The drive was failed 04/0300 08 Write Servo unsafe fault during Step 10, Butterfly In writes. 2) From UDS, The drive has been reported sense key 0 4-0300-08 Write Servo unsafe fault on Cyl:0x29758(169816) Hd:0x3(3) Sec:0x0(0). 3) Scope trace shows sign of modulation(3.18 kHz). 4) Track profile and SSP shows sign of written in modulation. 5) No CERT mapped defect nearby failing location. 6) PES from uds shows high position error on failing track during write. 7) P135 Final contact(retest) shows normal write and read contact DAC as comparison to P135@PRE2 but observed high delta write and read contact DAC on surface 1.	**Written in Mod**		Open

Factory Quality Issues (ORT) – Airwalker Suzhou/Korat

Drive Info.	Failure Mode	FA Findings	Root Cause	CA	Remarks
Hot /Ambient Failures					
CTF5-7 9XG13MZ7 03f1100 TTF: 772 hrs. Drive loaded (FW1232)	NMD	**EFA** NMD on surface 0, Zone 21 Failure analysis data : 1) From UDS, The drive has been reported 1 failing location on CHS:158004.0.812. 2) Scope trace shows amplitude signal dip at failing location. 3) Amplitude signal can not be recovered by overwrite. 4) No CERT mapped defect nearby failing location. 5) Normal CLR. **MFA status comment :** On visual inspection on external, there's no mechanical damage found outside the drive. After open top cover, no broken part or mechanical damage found inside the drive. - Scratch at PCC stiffener No anomalies found on retention torque reading during HSA tear down. On HSA inspection under low magnification, No contamination was observed on ABS and no mechanical defect found. Magnetic stress damage was found at NMD failing location (R"0.579") via Candela. No other anomalies observed around failing surface and other surfaces. **AFM-MFM analysis:** ---------- Magnetic stress damage was found at NMD failing location. Size of Magnetic stress damage at failing location is 0.711nm depth and 93.750nm width.	**NMD**		Open

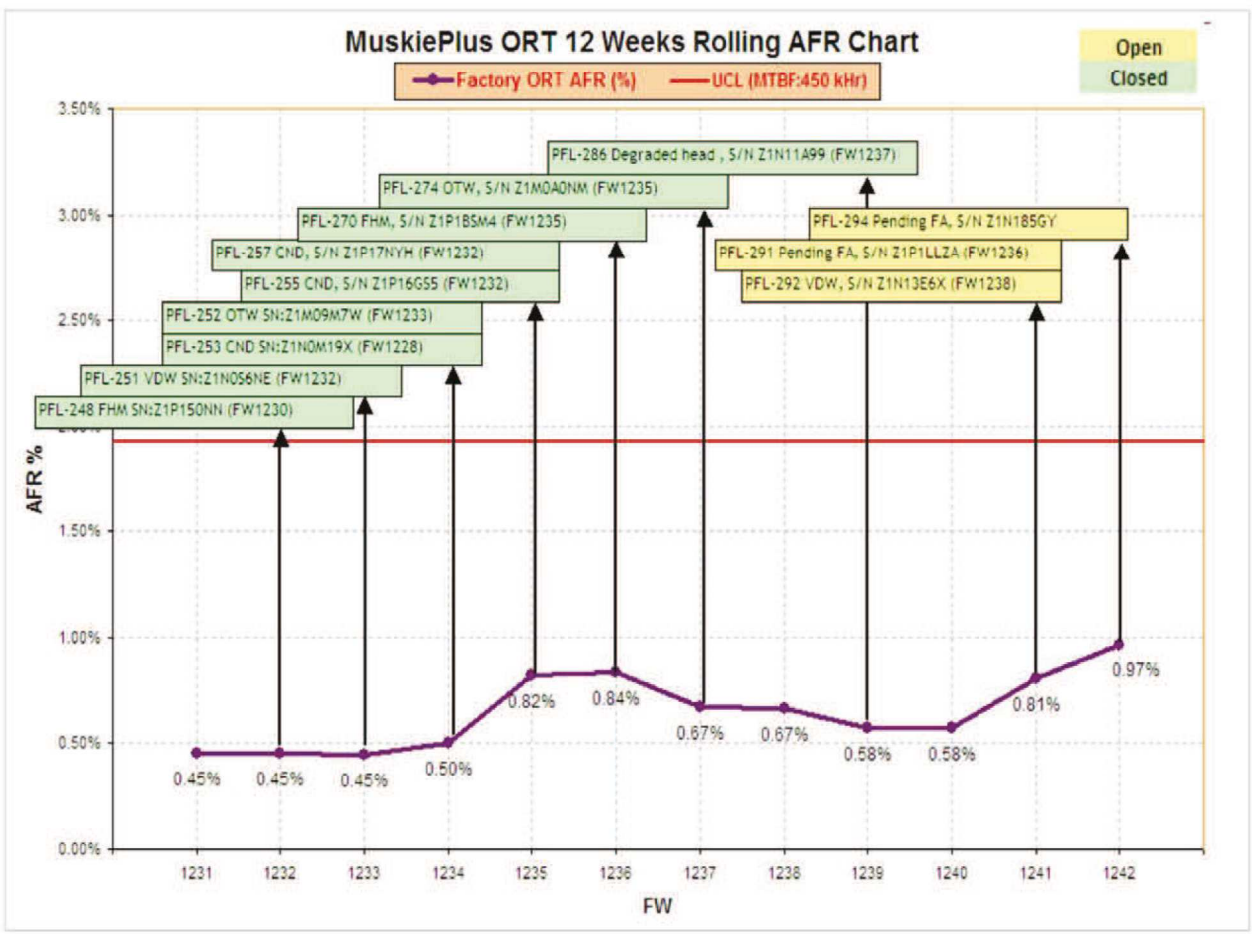
Factory Quality Issues (ORT) – Airwalker Suzhou/Korat

Drive Info.	Failure Mode	FA Findings	Root Cause	CA	Remarks
		Hot /Ambient Failures			
CTF5-6 9XE03VE3 03f1100 TTF: 34 hrs. Drive loaded (FW1235)	Weak Write	**EFA**Weak write on surface 0, zone 1 1) The drive was failed for sense key 43-1100 81 @Step 15, Random Reads. 2) The drive has been reported 1 failing location on CHS: 10617.0.1714 3) Scope trace shows amplitude signal dip about 3 sectors on failing location. 4) Track profile and scope sector profile shows sign of weak write. 5) Amplitude signal can be recoverable by overwrite. 6) No CERT mapped defect nearby failing location. 7) BER by zone shows poor on surface 0 (write read BER looks poor than read only BER). 8) P135 Final contact shows high delta both WRT and RD DAC on surface 0 as comparison to PRE2 and retest on bench data. **MFA result :** No anomalies found on retention torque reading during HSA tear down. On HSA inspection under low magnification, No contamination was observed on ABS and no mechanical defect found. There was no obvious mechanical defect found on MBA. Lube modulation found all over data zone (ID/MD/OD) of failing surface and also at data zone of another surface of the disc. Lube modulation was found severe at extreme OD, ID and MD zone. There was no signature of mishandling nor load scratch found on this drive.Potential cause is due to contamination. **MSL** - FESEM/EDX analysis found a lot of C/O/F/Si on ABS and C/Al/O/Si on flexure of both fail and control heads. SST400 was additional observation. It is suspected both heads were contaminated by Al base cast with e-coat material resulted in head poor flyability as sign of lube pick up finally cause Weak write failure on failing location. HDA; Hd0 Weak write, Contamination (e-coat) related	**Weak Write**		open

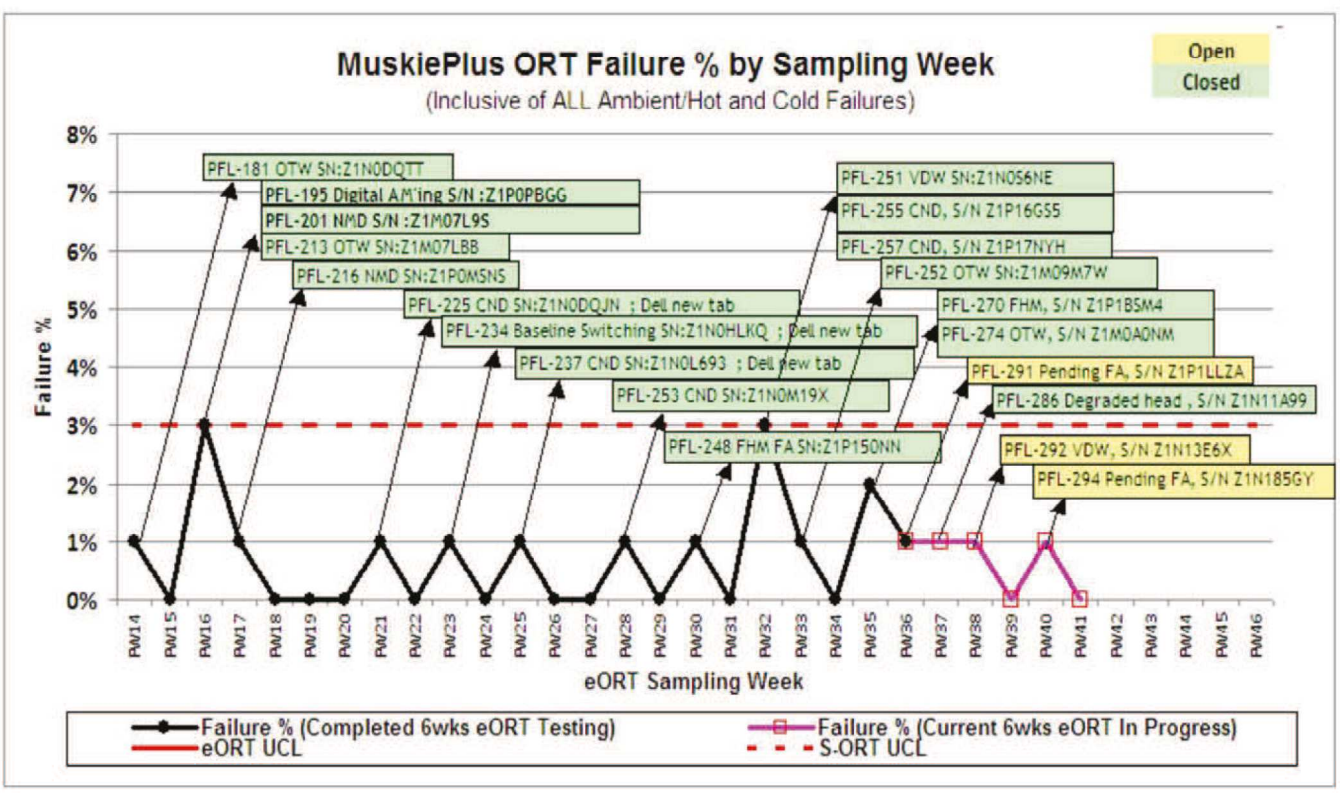
Factory Quality Issues (ORT) – Airwalker Suzhou/Korat

Drive Info.	Failure Mode	FA Findings	Root Cause	CA	Remarks
		Hot /Ambient Failures			
CTF5-5 9XF0VGN9 0W1802 TTF: 180 hrs. Drive loaded (FW1233)	Degraded Head on Head 0	**EFA** Degraded head on hd 0 Failure analysis data : - From SM2, the drive has reported 291 G-list on surface 0. - BER by zone shows poor on head 0. - DC over written can not show sign of defect and can recovered by over write. - MR resistance is normal. - No CERT mapped defect nearby failing location. - ISI result, The failed head (Hd 0) shows normal on transfer curve but SMAN noise is high Max noise Amp. - The observed heads,Hd 0 shows SMAN noise is high Max noise Amp **MFA** After open top cover, no broken part or mechanical damage found inside the drive. Media 30x VMI, No severe defect was found on top surface.	**Degraded Head**		Open
CTF5-4 9XG1032E 0W0300 TTF: 708 hrs. Drive loaded (FW1230)	Written in mod 18KHz	**EFA** Written in modulation (~18kHz) on surface 3, Zone 0 Failure analysis data : 1) From ORT log, The drive has been reported sense key 0W03 on Cylinder: 3208 Head: 3 Sector: 230. 2) Scope trace shows sign of modulation write ~18 kHz. 3) Track profile looks poor. 4) No CERT mapped defect nearby failing location. 5) P135 Final contact(retest) shows high delta write and read contact DAC (Decreasing) as comparison to P135@PRE2. - There was Airwalker drive, 9XG1032E with SORT WW35 failure submitted to **MSL for further analysis.** - EFA reported Written in modulation (~18 kHz) failure on surface 3, zone 0. No CERT mapped defect nearby failing location. P135 Final contact(retest) shows high delta write and read contact DAC (Decreasing) as comparison to P135@PRE2. - This failure drive was suspected to be related to contamination thus, HDA was passed through MSL for failure and tear down analysis. - Lube ripple on whole surface and along failing track was found on failing surface S3 while another passing surface was cleaned. - Talcum contamination was found on pole tip area on failed head/Hd3. Another head was cleaned. - Particle analysis result on 9XG1032E was shown in the below table (green column). 2 and 1 Talcum particles were found on HSA coil and base deck areas respectively. HDA; Hd3 Written in modulation, Contamination (Talcum) related	**Written in Mod**		Open

Muskie Plus ORT Failure 12 Week Rolling AFR Chart



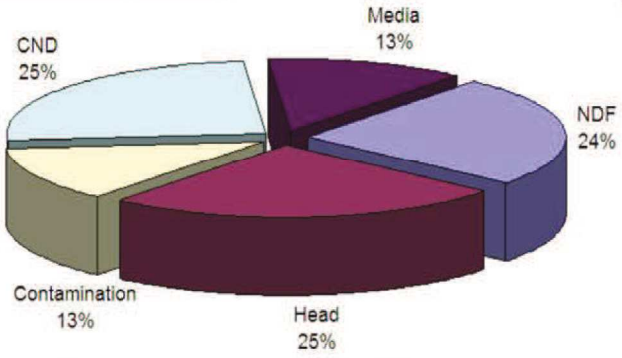
Muskie Plus ORT Failure % Chart by Sampling Week



MuskiePlus ORT Failure Pareto (FY12Q1 – FY12Q3)

MuskiePlus SORT Failure Pareto (FY12Q2)

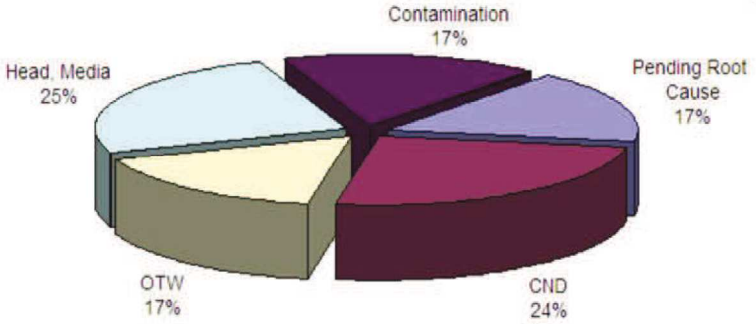
Sampling Week	Qty Tested	Steady State ORT Failure
FW1215 - FW1226	1,200	8
Total	1,200	8



2x OTW [Closed]_	2x NMD [Closed] ,[Closed]
1x Digital AM'ing [Closed]_	2x CND [Closed]_
1x Baseline switching [Closed]_	

MuskiePlus SORT Failure Pareto (FY12Q3-FY12Q4)

Sampling Week	Qty Tested	Steady State ORT Failure
FW1227-FW1240	1,500	12
Total	1,500	12



2x FHM [Closed]_	2x VDW [Closed], [Open]_
3x CND [Closed]_	2x OTW [Closed]_
1x Degraded Head [Open]_	2x Pending FA [Open]_

Factory Quality Issues (ORT) – MuskieNL

(Strictly for Seagate Internal Consumption only)

Drive Info.	Failure Mode	FA Findings	Root Cause	CA	Remarks
PFL-0291 Z1P1LLZA 10407 TTF: 712.5 hrs WWF: 1241 RW (CRX Passed): 24/2/2012 (FW1234) DOM (FW1236)		**FA Conclusion:** **Failure analysis data :**		Root Cause Corrective Action	Open

Drive Info.	Failure Mode	FA Findings	Root Cause	CA	Remarks
PFL-0292 Z1N13E6X Code 8 TTF: 407.7 hrs WWF: 1241 RW (CRX Passed): 8/3/2012 (FW1237) DOM (FW1238)	VDW	**FA Conclusion:** VDW (Fly over CERT mapped defect – TA) on surface 0, Zone 1 **Failure analysis data :** -The drive was failed for Port Fault Code: 8 - Excess soft errors; Code = 19 -From UDS, The drive has been reported 01/18/07 on CHS:28095.0.328 and 3 G-list observed. -Scope trace shows amplitude signal dip at failing location. -Disc scape shows CERT mapped defect – TA (Amp width =312) nearby failing location (~219 tracks). - Signal canbe recovered by overwrite. - Normal CLR.		Root Cause Corrective Action	Open

Drive Info.	Failure Mode	FA Findings	Root Cause	CA	Remarks
PFL-0294 Z1N185GY 10704 TTF: 163 hrs WWF: 1242 NB (CRX Passed): 21/03/2012 (FW1239) DOM (FW1240)		**FA Conclusion:** **Failure analysis data :**		Root Cause Corrective Action	Open

Factory Quality Issues (ORT) – MuskieNL

(Strictly for Seagate Internal Consumption only)

Drive Info.	Failure Mode	FA Findings	Root Cause	CA	Remarks
PFL-0286 Z1N11A99 10407 TTF: 306.4 hrs WWF: 1239 NB (CRX Passed): 9/3/2012 (FW1236) DOM (FW1237)	Degraded head	**FA Conclusion:** Degraded head on head 3 **Failure analysis data :** -The drive aborted at LBA#62CC4FCD CHS: 02C883.3.0133. -Scope signal show normal amplitude. -Error rate on bench showed marginal hd_3. -OTC plot show un-recovered read. -No CERT mapped defect close to the failing location. MR resistance on bench, the result show increase (40 ohms) when compare with process test. ISI test: ISI result show high Pk-Pk Amp on head 3.	Degraded head	Root Cause - Head degraded; high amplitude and nonlinear on Transverse Curve. Corrective Action - Plat PTR Heads / Cut in WW37 - Spike Noise screen / Cut in WW37	Close

Muskie Plus PDMT Test Status Update (FW1240~FW1252)

No.	Test Description	Test Conditions	Specifications	Qty Tested	Test Results	Last Quarter Test Results	Current Quarter Issues
1	Ambient Load UnLoad Soft (ALULS 600K)	Room Ambient Nominal Voltage	600K Cycles with no unrecoverable Errors	65	In Progress	65x Passed	None
2	Side Track Erasure (STE)	Room Ambient Nominal Voltage	Spec: 100K Writes Margin: over 100k Writes No unrecoverable errors	104	In Progress	103x Passed 1x Failure	None
3	Weekly Acoustic Monitor (WAM)	Room Ambient Nominal Voltage	FC / SAS: 2D / 4HD (LDD) , 3D/ 6HD (LD), 4D/ 8HD (LP) : Performance Seek Mode (Bels) : 3.8bels Idle (typ): 2.3 bels	130	In Progress	130x Passed	None
4	Altitude Audit (ALTA)	Room Ambient Nominal Voltage	10K feet operating No unrecoverable errors	39	In Progress	39x Passed	None
5	Non Operating Shock (NOS)	Room Ambient Nominal Voltage	Spec: 300G 2ms half sine Beyond Spec: 350G 2ms half sine	27	In Progress	27x Passed	None
6	Rotational Operating Vibration (RROV)	Room Ambient Nominal Voltage	RROV Spec: (21 rad/s2 RMS) : 10-1500 Hz w/20% perf reduction	6	In Progress	6x Passed	None
7	Operating Vibration Random (OVR)	Room Ambient Nominal Voltage	OVR Spec: 10-300Hz (1.0Grms) 300 - 500Hz (0.5Grms)	9	In Progress	9x Passed	None
8	Topple Drop (TD)	Room Ambient Nominal Voltage	3 axes' drops in 4 orientations. No permanent physical damage on drive or data corruption.	9	In Progress	9x Passed	None
9	Corrosion 21 days (Corr21D)	Soak @60C / 80%RH	No unrecoverable errors after soak	30	In Progress	10x Passed	None
10	Thermal Voltage Margin (TVM)	3 Cold/Hot cycles Temp: 0°C to 60°C Voltage Margin: 5V +/- 5%, 12V +/- 5%	Temp Spec: 5°C to 55°C Voltage Margin: 5V +/- 5%, 12V +/- 5% Recovered Data: Less than 10 errors in 1012 bits transferred Unrecovered Data: No error	48	In Progress	48x Passed	None
11	Transit Storage Environment (TSE)	Temp: -40°C to 70°C Humidity: 5% to 95% RH	No unrecoverable errors after soak	10	In Progress	10x Passed	None
12	Single Head Sequential Stress Test(SHST)	Temp: 65°C Nominal Voltage	No burnish related failures. Failure analysis is pefomed if there is an unrecoverable error or the delta BER exceeds 0.62 or 1.0 depending on products.	96	In Progress	94x Passed 2x Failure	None

Muskie Plus PDMT : FA Summary

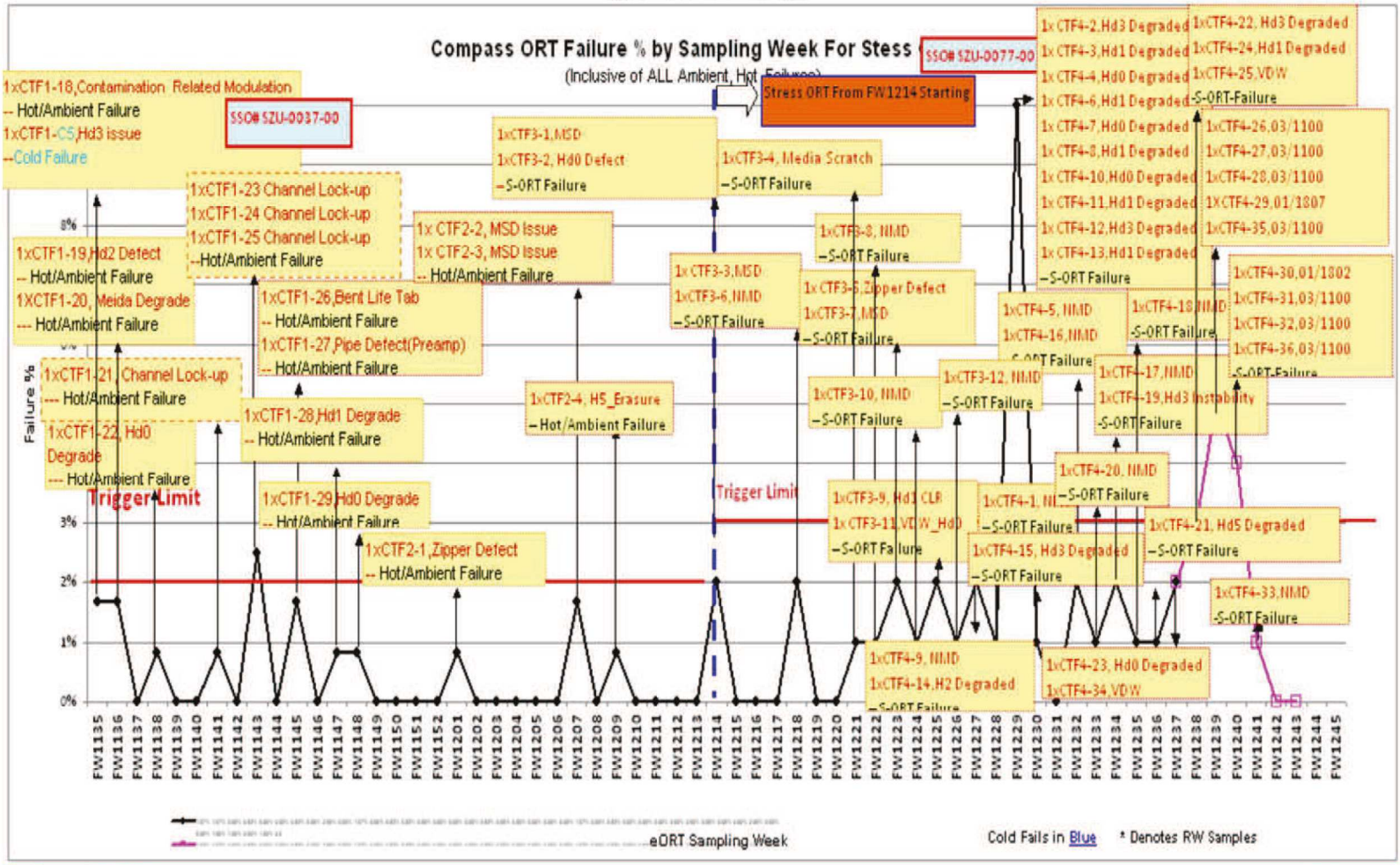
FW	Sent to FA Date	Product	Test Item	Serial Number	Fail Code Description	Fail Sequence	TTF	Temp	OWNER	EFA	Head FA / MSL
FW 1219	2011/12/21	Muskie Plus	SHST	Z1M08ZSD	N/A	dBER > 0.62 decade	N/A	65C	Saranyu Laopa	BER degradation on surface 0	NPF
FW 1222	2012/01/17	Muskie Plus	SHST	Z1M07Z1W	03/1100	30 min random write/read at 65C on OD 1/6 of cylinders	190.9Hrs	65C	Saranyu Laopa	VDW(fly over CERT mapped defect – TA) on surface 0, zone 0	Particle Scratch was found at failing location. Size of defect is height~13.572 nm and width~429.69 nm.
FW 1222	2012/02/03	Muskie Plus	SHST	Z1M07Z1V	N/A	dBER > 0.62 decade	N/A	65C	Saranyu Laopa	BER degradation on surface 0	Head degraded; high noise.
FW 1227	2012/02/27	Muskie Plus	SHST	Z1P0ZA5Q	N/A	dBER > 0.62 decade	N/A	65C	Saranyu Laopa	BER degradation on surface 0	Uniform DLC wear and light scratch with angle ~13-14 degrees.
FW 1234	2012/3/13	Muskie Plus	STE	Z1N0XHKX	03/11FF	SEQ FWD RD AFTER MULTIPLE ZONE TEST (STEP 11)	175 Hrs	20C	Saranyu Laopa	CND	/
FW 1232	2012/03/28	Muskie Plus	SHST	Z1N0O7M4	04/0300	Sequential writing at 65C	615 Hrs	65C	Saranyu Laopa	Written in modulation (8.6 kHz) on head 0,zone 0, high RV in the same time that failed un-recovered write. suspect external vibration.	/

Muskie Plus - FE Table 04/20/12

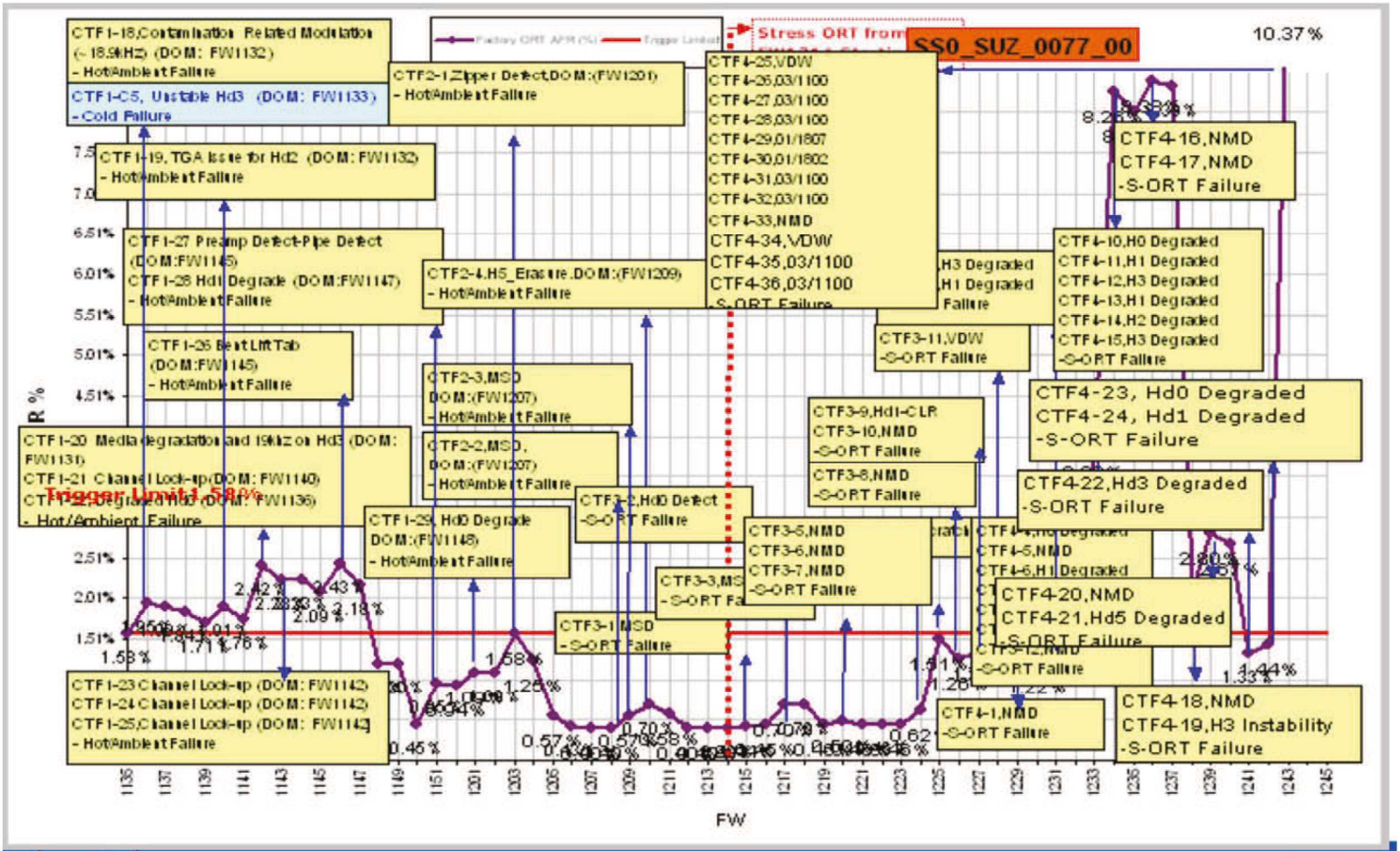
AFR (1st Year Weibull):	2.37%	From all fails Weibull MLE	0	Integration Hours	
MTBF (1st Year Weibull):	365K		8760	POH/Year	
Minimum AFR:	0.16%	From zero fail Weibull @ 50% CL	0.5448	Weibull Beta	
				Average Test Hours	

Issue	Corrective Action	Fix Validation (TTF in Hours)	# of Failures	% Fail Attributed to	Eff. Factors		AFR Reduced By	
					Validated	Potential	Validated	Potential
PFL-294 Pending FA, S/N Z1N185GY		(PFL/TTF: 294/163)	1	0.20%	0%	0%	0.00%	0.00%
PFL-292 VDV, S/N Z1N13E6X		(PFL/TTF: 292/407.7)	1	0.20%	0%	0%	0.00%	0.00%
PFL-291 Pending FA, S/N Z1P1LLZA		(PFL/TTF: 291/712.5)	1	0.20%	0%	0%	0.00%	0.00%
SPPL-026, Degraded head , S/N Z1N11A99	Flat PTR Heads/Spike Noise screen.	(PFL/TTF: 286/306.4)	1	0.20%	75%	100%	0.15%	0.20%
SPPL-016: Offtrack write	Need to retest to verify	Rerun pass at 3X TTF (PFL/TTF: 274/239.38)	1	0.20%	100%	100%	0.20%	0.20%
SPPL-025, S/N Z1P1BSM4	Manual DSP loading tools implementation, Eliminate Blue Mat.	(PFL/TTF: 270/8.32)	1	0.20%	50%	100%	0.10%	0.20%
SPPL-004: CND - Hard error code	Need to retest to verify	Rerun pass at 3X TTF (PFL/TTF: 257/283.3)	1	0.20%	100%	100%	0.20%	0.20%
SPPL-004: CND - Hard error code	Need to retest to verify	Rerun pass at 3X TTF (PFL/TTF: 255/265.3)	1	0.20%	100%	100%	0.20%	0.20%
SPPL-001: Aborted Command to be CND	Need to retest to verify	Rerun pass (PFL/TTF: 253/931.7)	1	0.20%	100%	100%	0.20%	0.20%
SPPL-016: Offtrack write	Need to retest to verify	Rerun pass at 3X TTF (PFL/TTF: 252/19.1)	1	0.20%	100%	100%	0.20%	0.20%
SPPL-024: VDV	beat-up(OD) 5 loop and random write and read.	(PFL/TTF: 251/128.14)	1	0.20%	75%	100%	0.15%	0.20%
		Total Failures	11		Reduced AFR		0.967%	0.77%
					Corresponding MTBF		901,727	1139K

Compass ORT Failure % Chart by Sampling Week For Stress – (FW1243)



Compass ORT AFR Trend Chart – (FW1243)

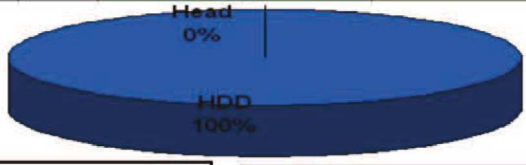


Compass ORT Failure Pareto (FY12Q3/FY12Q4)

Compass ORT Failure Pareto (FY12Q3/FY12Q4) – 1st Quarter into Production (SAD in

Sampling Week	Qty Tested	ORT TVM Failures		Steady State ORT Failure
		Hot/Ambient Failures	Cold Failures	
FW1227-FW1239 Stress ORT From FW1214	1,200			24 3xNMD 12xHead Degraded 3xNMD 2xHead Degraded 2xNMD 1xHead Instability 1xError 01/1807 4xHead degraded
Total	1,200			24

Sampling Week	Qty Tested	ORT TVM Failures		Steady State ORT Failure
		Hot/Ambient Failures	Cold Failures	
FW1240-FW1243 Stress ORT From FW1214	400			5 1xNMD 3x03/1100 1x01/1807
Total	400			5



1x NMD
FA In progress

1x NMD
FA In progress

1x NMD
FA In progress

1x Head Degraded
FA In progress

1x Head Degraded
FA In progress

1x Head Degraded
FA In progress

1x Head Degraded
FA In progress

1x Head Degraded
FA In progress

1x Head Degraded
FA In progress

1x Head Degraded
FA In progress

1x Head Degraded
FA In progress

1x Head Degraded
FA In progress

1x Head Degraded
FA In progress

2x NMD
FA In progress

3x03/1100
FA In progress

1x01/1807
FA In progress

1xNMD
FA In progress

Factory Quality Issues (ORT) – Compass Suzhou

Due to CFT4-25~CTF4-36, All drives still pending in FA. So no details formation can be updated.

Factory Quality Issues (ORT) – Compass Suzhou

Drive Info.	FA Findings	Root Cause	CA	Remarks
Hot /Ambient Failures				
CTF4-24 6XP2FV04 TTF: 589hrs RW DOM (FW1238)	Suzhou Elect FA 1,Writing different patterns on both heads.Head1 signal shows lower amplitude comparing with hd0. 2,Measured resistance on bench ,both heads' resistance no obvious change. 3,No TA and cert defect are closed to failing location. 4,EFA Conclusion: Hd1 Degraded	Hd1 Degraded	Pending in Mech FA	Open

Factory Quality Issues (ORT) – Compass Suzhou

Drive Info.	FA Findings	Root Cause	CA	Remarks
Hot /Ambient Failures				
CTF4-23 6XP2H2OV TTF: 617hrs RW DOM (FW1237)	Suzhou Elect FA 1,Track profile also confirm weak write on failing track. 2,H0 was observed amplitude baseline shift by scope. 3,H0 Fly Height was comparable with PRE2 RD/WRT HEAT DAC. 4,No TA near by failing location. 5,EFA Conclusion: H0_Degraded	H0_Degraded	Pending in Mech FA	Open

Factory Quality Issues (ORT) – Compass Suzhou

Drive Info.	FA Findings	Root Cause	CA	Remarks
Hot /Ambient Failures				
CTF4-22 6XR27ECK TTF: 317hrs RW DOM (FW1238)	Suzhou Elect FA No amplitude loss observed @ the failing location via scope & track profile. Normal CLR in Pre 2. The failing location is not the Plist related. EFA Conclusion: H3_Degraded	Hd3 Degraded	Pending in Mech FA	Open

Factory Quality Issues (ORT) – Compass Suzhou

Drive Info.	FA Findings	Root Cause	CA	Remarks
Hot /Ambient Failures				
CTF4-22 6XR27ECK TTF: 317hrs RW DOM (FW1238)	Suzhou Elect FA No amplitude loss observed @ the failing location via scope & track profile. Normal CLR in Pre 2. The failing location is not the Plist related. EFA Conclusion: H3_Degraded	Hd3 Degraded	Pending in Mech FA	Open

Factory Quality Issues (ORT) – Compass Suzhou

Drive Info.	FA Findings	Root Cause	CA	Remarks
Hot /Ambient Failures				
CTF4-21 6XS20GYA TTF: 351hrs RW DOM (FW1236)	**Suzhou Elect FA** 1,No anomaly observed by scope. 2,Hd5 poor bench BER. 3,No anomaly observed in T135 clearance. 4,No anomaly observed in media plot. 5,EFA conclusion: Hd5 Degraded **Suzhou Mech FA** No anomalies found.	H5 Degraded	Pending in Head FA	Open

Factory Quality Issues (ORT) – Compass Suzhou

Drive Info.	FA Findings	Root Cause	CA	Remarks
Hot /Ambient Failures				
CTF4-20 6XR1Z2W3 03/1100/81 TTF: 720hrs RW DOM (VMI) (FW1233)	**Suzhou Elect FA** 1,Build Type :RW . Line: 106, SBR:STD, No anomaly observed by VMI. 2,03/11 can be reported while reading failing location and its adjacent track 171181. Amplitude drop can be observed @ CHS :171180,2,380 BFI:517681,wedge:432 It can't be recovered after overwriting. 3,No anomaly observed in PRE2 clearance data. 4,No TA and cert defect are closed to failing location. 5,EFA Conclusion: NMD_S2_Zn30. **Suzhou Mech FA** MSD **MSL** MSD	NMD	**Corrective Action** 1,Supplier perform spacer double washing in ww32 2,Add 4hrs (2xlooper) sequence ready/write verify in CUT2 3.Add 0.5hr random write/read in FIN2 4,Increase CSS looper from 25x to 50x in MQM2 5,Add Full pack Sequential verify in MQM2 Done by FW1236	Closed

Slider Reliability Test (ESD stress)

Elaborated with Boulder Platform's Baseline data.

HonSeng Chan

Seagate
We turn on ideas

Q4 FY12
May 2012

Test Description and Results

Goal: To determine Boulder platform ESD V_{fail} baseline using CDM, VZAP, HBM and MM module.

Parts used for experiment:

[redacted]

Test Method:

[redacted]

Test Criteria:

[redacted]

Results [redacted]

[redacted]

ESD Test Algorithm

[redacted]

ESD Test Algorithm

Boulder ESD Results Tables:

CDM — Fail V = Combo

CDM	Vfail1 R	Vfail1 Ampl.	Vfail1 Pol.	Vfail1 Popcorn	Vfail1 SNR	Vfail1 Kink	Vfail1 Combo
count	10	20	0	62	62	0	120
initial passers				121			
fraction	8%	17%	0%	51%	51%	0%	99%
avg	3.96	3.68	####	3.32	3.36	####	3.351
std	0.46	0.47	####	0.64	0.64	####	0.644
max	4.8	4.8	0	4.7	4.6	0	4.8
min	3.3	3	0	0.6	0.8	0	0.6
avg - 3 std	2.57	2.29	####	1.4	1.45	####	1.418
Tested				175			

Avg. Res 277.81 ohm
Avg. Amp 7601.34 uV

VZAP — Fail V = Combo

VZAP	Vfail1 R	Vfail1 Ampl.	Vfail1 Pol.	Vfail1 Popcorn	Vfail1 SNR	Vfail1 Kink	Vfail1 Combo
count	50	48	4	43	66	0	127
initial passers				128			
fraction	39%	38%	3%	34%	52%	0%	99%
avg	1.72	1.73	1.88	1.37	1.58	####	1.529
std	0.2	0.21	0.1	0.38	0.25	####	0.312
max	2.2	2.2	2	1.9	2.2	0	2.2
min	1.3	1.3	1.8	0.3	1.1	0	0.3
avg - 3 std	1.13	1.11	1.59	0.21	0.83	####	0.594
Tested				173			

Avg. Res 272.80 ohm
Avg. Amp 7587.11 uV

HBM — Fail V = Combo

HBM	Vfail1 R	Vfail1 Ampl.	Vfail1 Pol.	Vfail1 Popcorn	Vfail1 SNR	Vfail1 Kink	Vfail1 Combo
count	99	96	47	10	95	0	113
initial passers				113			
fraction	88%	85%	42%	9%	84%	0%	100%
avg	14.5	14.6	16.2	4.75	14.7	####	13.52
std	5.67	5.75	5.86	4.04	5.79	####	6.171
max	30	30	29	14	30	0	30
min	7	7	7.5	0.5	7	0	0.5
avg - 3 std	-2.5	-2.7	-1.4	-7.4	-2.7	####	-5
Tested				171			

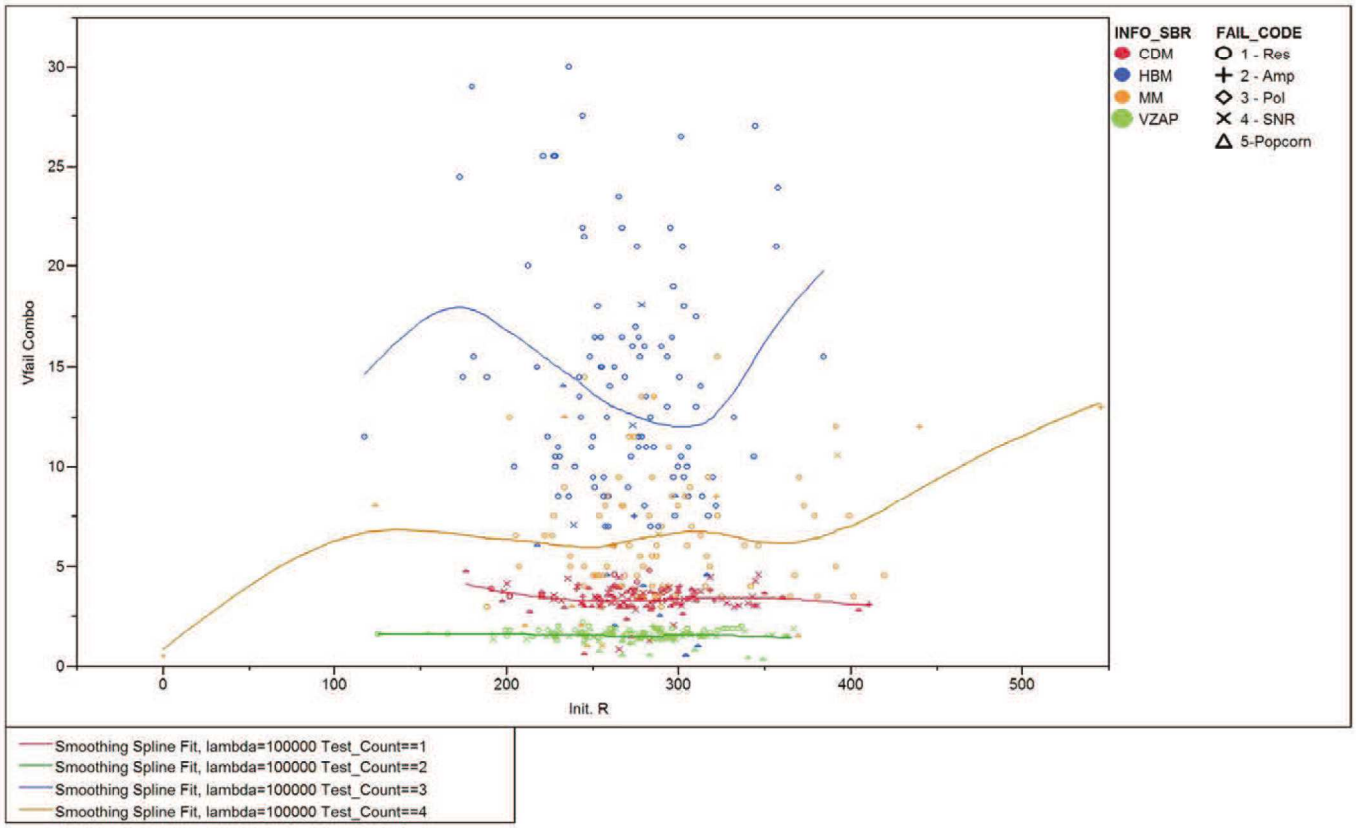
Avg. Res 269.18 ohm
Avg. Amp 10167.52 uV

MM — Fail V = Combo

MM	Vfail1 R	Vfail1 Ampl.	Vfail1 Pol.	Vfail1 Popcorn	Vfail1 SNR	Vfail1 Kink	Vfail1 Combo
count	85	87	44	8	83	0	99
initial passers				100			
fraction	85%	87%	44%	8%	83%	0%	99%
avg	6.49	6.63	7.15	4.19	6.74	####	6.399
std	2.85	2.97	3.19	4.01	3.04	####	3.174
max	15.5	15.5	15.5	12.5	15.5	0	15.5
min	3	3	0.5	1	1	0	0.5
avg - 3 std	-2.1	-2.3	-2.4	-7.8	-2.4	####	-3.12
Tested				159			

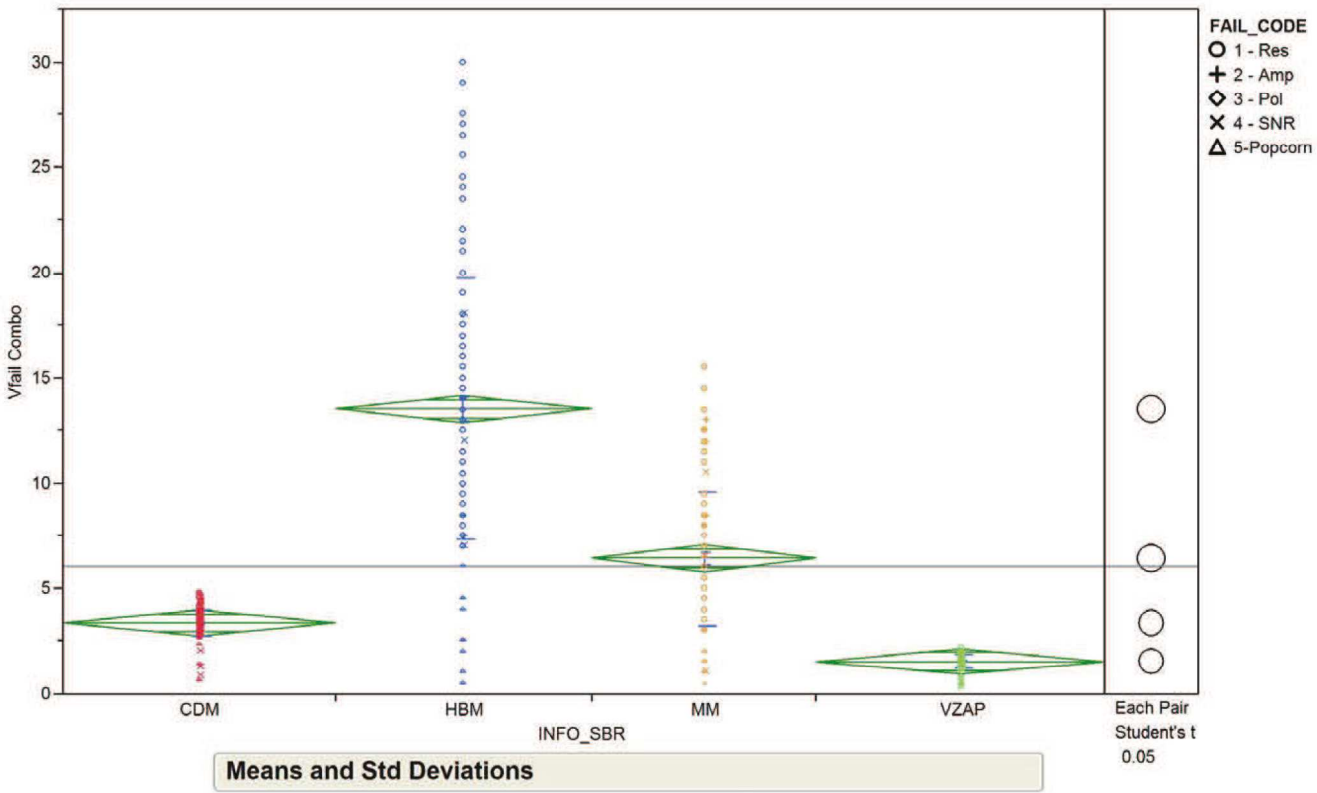
Avg. Res 269.18 ohm
Avg. Amp 9685.30 uV

ESD Results: V_{fail} vs Resistance



V_{fail} does not appear to be strongly resistance-dependent

ESD Overall-V_{fail} Level Module

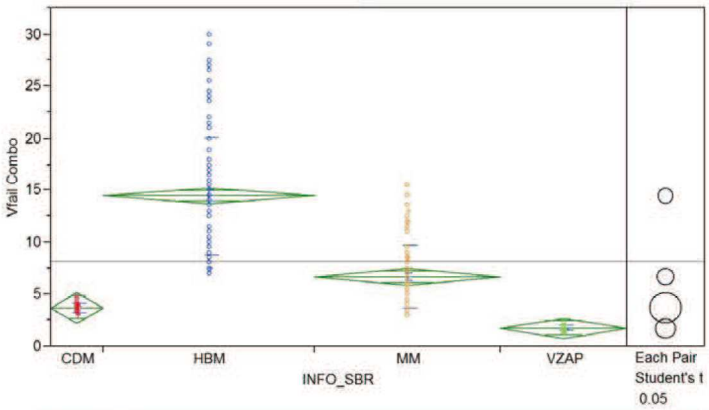


Means and Std Deviations

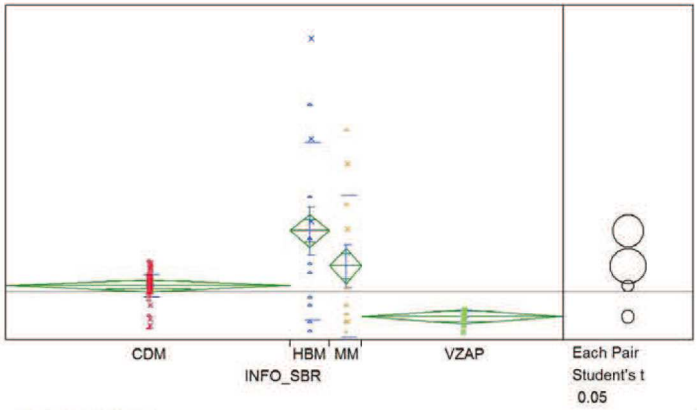
Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
CDM	120	3.3508	0.64417	0.05880	3.234	3.467
HBM	113	13.5177	6.17126	0.58054	12.367	14.668
MM	99	6.3990	3.17434	0.31903	5.766	7.032
VZAP	127	1.5291	0.31171	0.02766	1.474	1.584

V_{fail} Level by Res/Amp or Stability

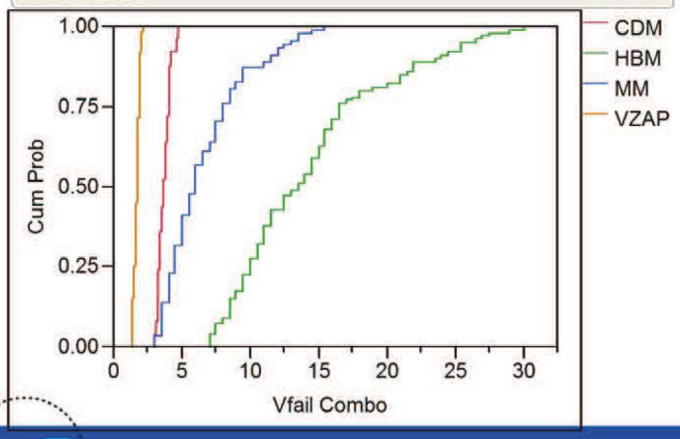
Resistance or Amplitude Failures Only



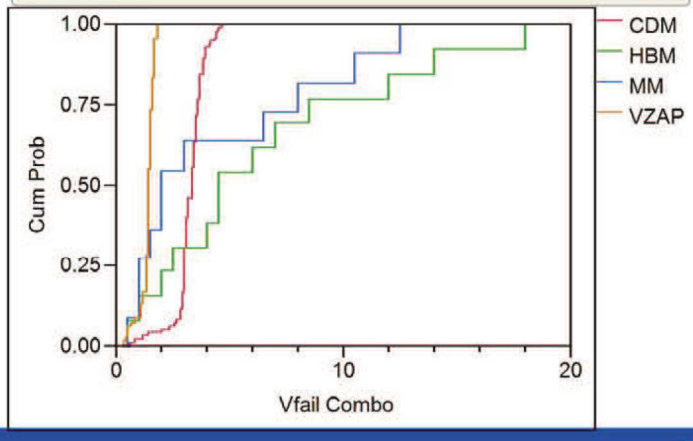
Stability Failures Only



CDF Plot



CDF Plot



Summary of Extensive Discussion:

- **RHO: Alan Johnston, Chad Barry, Elzbieta Haftek, Helen Liang, Hongtao Zhu, Jay Loven, Kristin Duxstad, Mark Re, Mohammed Patwari, Scott Stokes, Wayne Bernard, Yonghua Chen**
- **TCO: Ghassan Abdelnour, Carmen Guinta**
- **Asia Engineering: Chaiyut Pongtrongjit, CingSiong Lim, Jeff Nygaard, KeanCheong Oh, Peerapong Pimolphan, Roong Sivaratana, Sirirat Euaypadung, Sombat Pongtirasuwan, Supot Soommat, TeeYu Choo, ZeeYee Chew**

Head Instability Improvement Strategy

- Near Term – Released Products Instability Issue Containment
- Improving Testing and Control Process – to effectively assess and manage the existing design margin
  - Testing: where & what to test
  - Control: managing unwanted stressors
- Longer Term – Development Products on Stability Margin Improvement
- Improving Development Process – ultimately to improve the design margin
  - Technical: effective learning and feedback process to design
  - Business Process: focused ownership to deliver design margin that meets the product head stability requirements **during development stage**

Near Term on Release Product Instability Containment – Improving Testing and Control Process

- Priority:
  1. Contain the issues
  2. Explore more efficient way to contain the issue
- Testing: where & what to test
  - [redacted]
  - [redacted]
- [redacted]
  - [redacted]
  - [redacted]

Head Instability Issue & Strategy

[redacted]

Strategy Proposal

[redacted]

Notes:

- It is known that HSA level tests or screening has cost / capacity concerns. This effort should eventually lead a more effective way in component level screening
- Bar level ISI tests / screening vs drive tests correlation has been explored multiple times and shown limited effectiveness due to too many process steps in between the two stages.
- There has been observations of changed reader metrics after BAR level ISI testing which indicating reader stressors exist in current component processes

Establishing HSA Level Stability Test Control

- Notes:
  - QST (Quasi Static Testing, ISI + SMAN) providing fundamental physics based reader quality characterization will be used as the primary tool for reader instability assessment.
  - HSA ISI proposal here can be served either as a bridge to establish the better screening at bar ISI & HGA ET or as a permanent tool to contain instability issues at component level .
  - 6-Sigma black belt support will be needed to finalize the plan here

HSA Level Stability Issues Flow Down

[redacted]

Component Stability Tests Optimization

[redacted]

[redacted]

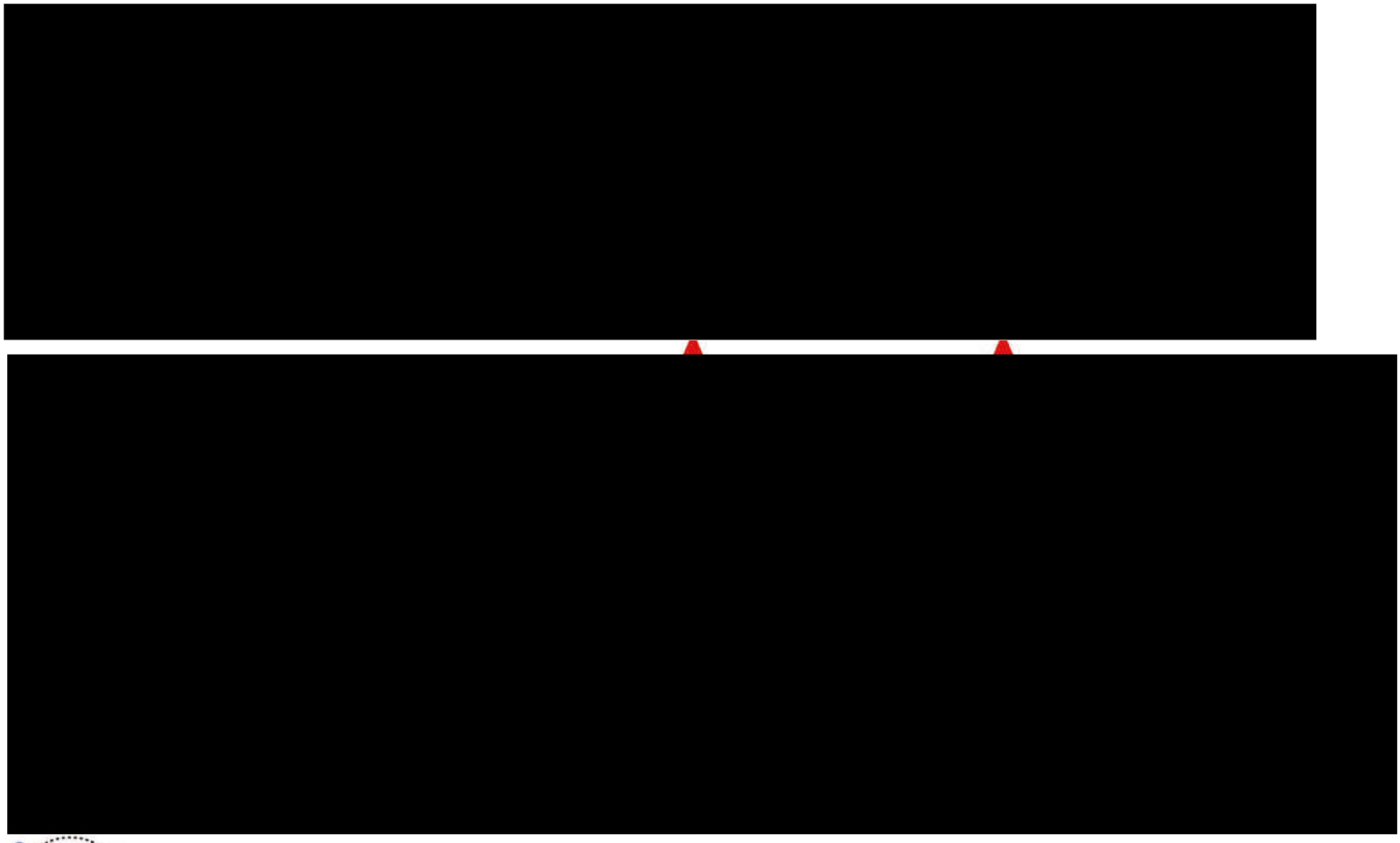
Longer Term on New Product Design Margin Improvement – Improving Development Process

- Technical: effective learning and feedback process to transducer design
  - Design component level full evaluation
  - Drive FA
- Business Process:
  - Goal has to be providing sufficient head instability margin **during development stages**
  - Enhance RHO development team's **sense of ownership** on head instability during the development stages

Transducer Reader Design Feedback Process

[redacted]

Reader Development Related Business Process



Backup

ISI: Production vs. FDB vs. Stress Test

Upstream Test Detection (UTD) Study

- Electronic components and PCBA

IngMing Ooi, Chris Farnell, Yue Ma

Q4 FY12
May 2012

HIGHLY CONFIDENTIAL

Seagate
We turn on ideas

Goal

- Establish good correlation between component and drive level test.
- Detect more latent issues in upstream test, finding and solving problems in earlier stage.
- Involve suppliers to further control component quality

Project Proposal:

- Review component tests to find gap between component and drive level test
- Improve current or develop new component level test for better simulating drive usage in field
- Work with suppliers to implement the new test routine in upstream

Test items reviewed

- **Power management**
  - Power margining
  - Power cycling
- **Servo control**
  - Seek (Long Seek, Random Seek)
  - LUL/CSS
- **Write/Read operation**
  - Head Switching
  - Heater Protrusion
  - Multiple WR
  - Write Pattern
- **Environment impact**
  - Temperature
  - Humidity
  - Altitude
  - Shock & Vib

Power Management:

Servo Control:

Write/Read operation:

Environment impact:

[redacted]

Thoughts on supplier reliability test

- [redacted]
- [redacted]
- [redacted]

STX consign wafer- Grenada MRR package

SAEBU4 PE/QA

Mar,2-2012

→OBA (Outgoing Bag/Box Audit)
→ ORT Cleanliness
→ Reliability
→ Process Cpk
→ GR&R and Correlation

→ OBA (Outgoing Bag/Box Audit)

OBA RULE

QA is responsible for OBA;

All parts can not be shipped to customer without passing OBA;

The whole lot must be sorted or scrapped once failed OBA;

SAE sends OBA trend data to customer on weekly basis.

OBA – Grenada

OBA Summary

Program		Grenada Consign wafer			
OBA		Wk48_UP	Wk48_DN	Wk49_UP	Wk49_DN
VMI	Lot Inspect	1	1	1	1
	Lot Reject	0	0	0	0
	Reject	0	0	0	0
	DPPM	0	0	0	0
LG	Lot Inspect	1	1	1	1
					0
					0
					0
					2.477
PSA					1
					0
					0
					0
					1.420
RSA					1
	Lot Reject	0	0	0	0
	Reject	0	0	0	0
	DPPM	0	0	0	0
	CPK	**2.632**	**2.639**	**2.438**	**2.619**

OBA – Grenada

OBA Mechanical Spec

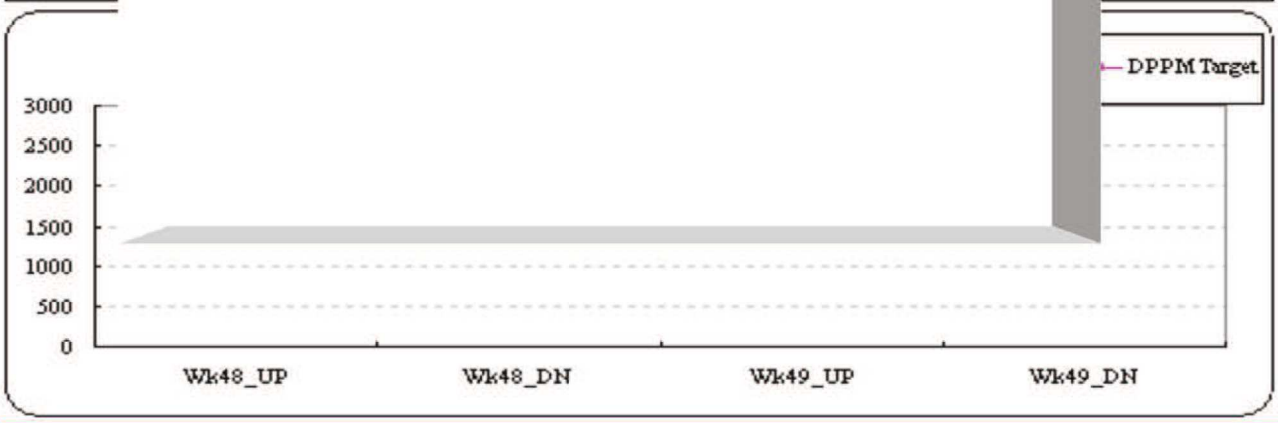
OBA spec	LSL	USL	Target
LG	2.30	2.70	2.50
PSA	87	165	126.00
RSA	-39	39	0.00

OBA RESULT – Grenada OBA Visual

Visual

Grenada HGA OBA Visual Inspection DPPM Trend chart

Lot No.		Wk48_UP	Wk48_DN	Wk49_UP	Wk49_DN
Inspected Q'ty		1	1	1	1
Rejected Q'ty		0	0	0	0
Lot Rejected					
Failure Description	Contamination on slider side wall				
	Contamination on suspension				

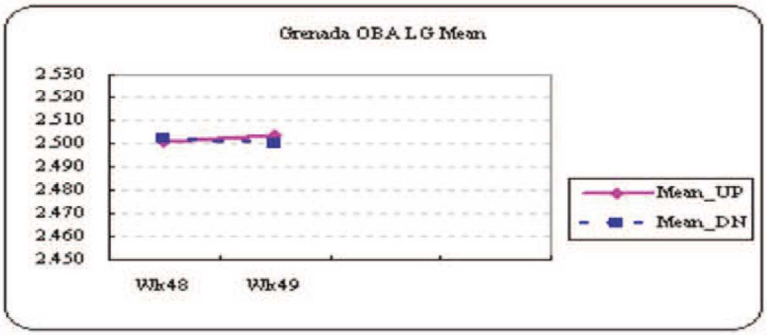


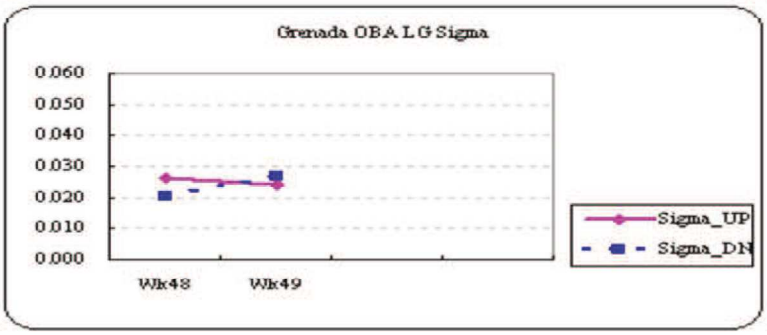
OBA RESULT – Grenada OBA LG

LG:

Grenada consign wafer OBA LG data trend chart

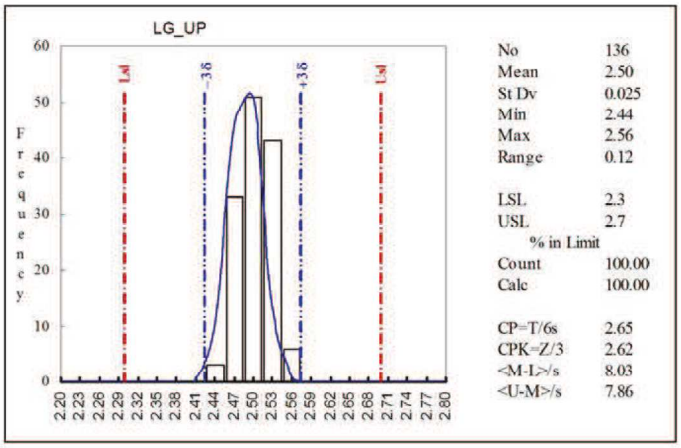
Lot No.	Wk48	Wk49
Mean_UP	2.501	2.504
Sigma_UP	0.026	0.024
Max_UP	2.560	2.550
Min_UP	2.440	2.450
Cpk	2.526	2.720
Mean_DN	2.502	2.500
Sigma_DN	0.020	0.027
Max_DN	2.540	2.580
Min_DN	2.440	2.430
Cpk	3.274	2.477
LSL(g)	2.3	2.3
USL(g)	2.7	2.7

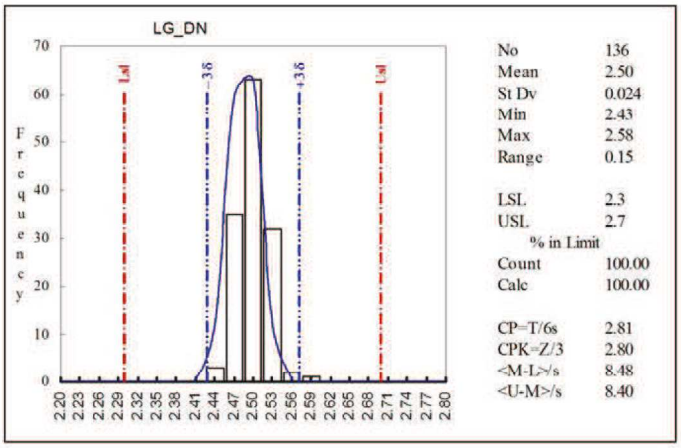




OBA RESULT – Grenada OBA LG Distribution

LG



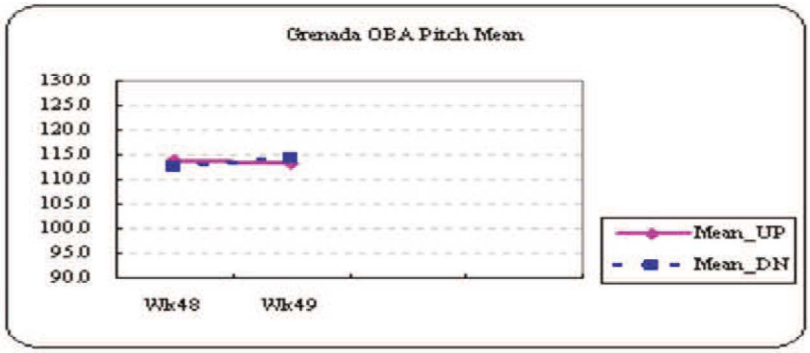


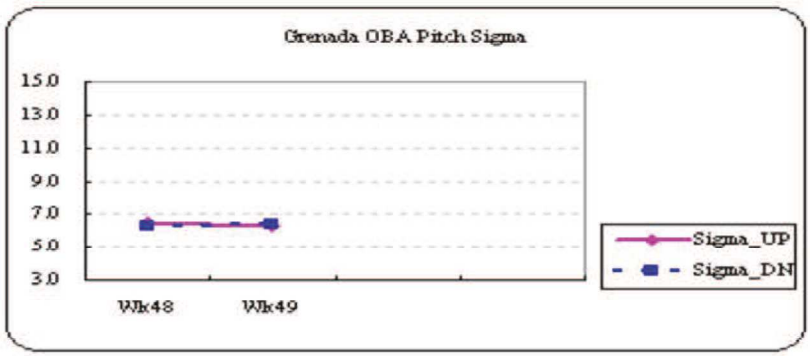
OBA RESULT – Grenada OBA PSA

PSA:

Grenada consign wafer OBA Pitch data trend chart

Lot No.	Wk48	Wk49
Mean_UP	113.860	113.257
Sigma_UP	6.465	6.308
Max_UP	123.770	128.400
Min_UP	100.750	100.010
Cpk	1.385	1.388
Mean_DN	112.357	114.325
Sigma_DN	6.253	6.413
Max_DN	129.200	128.330
Min_DN	95.210	100.730
Cpk	1.352	1.420
LSL(g)	87	87
USL(g)	165	165



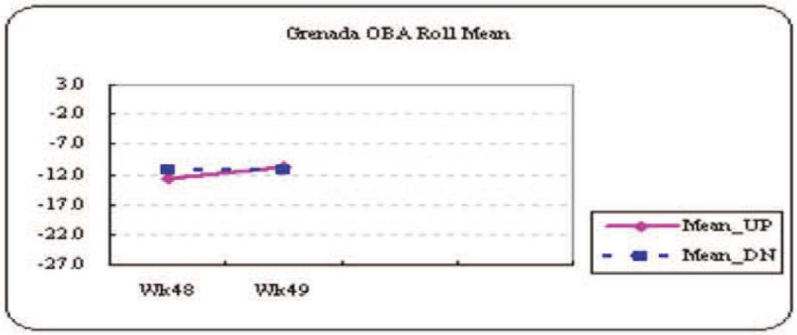


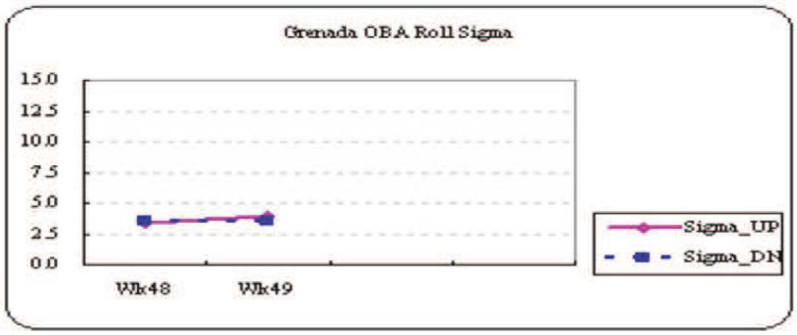
OBA RESULT – Grenada OBA RSA

RSA:

Grenada consign wafer OBA Roll data trend chart

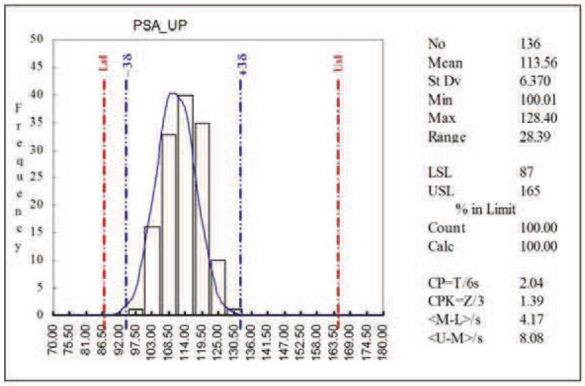
Lot No.	Wk48	Wk49		
Mean_UP	-12.705	-10.728		
Sigma_UP	3.331	3.865		
Max_UP	-4.980	-3.950		
Min_UP	-20.760	-18.240		
Cpk	2.632	2.438		
Mean_DN	-11.360	-11.428		
Sigma_DN	3.492	3.509		
Max_DN	-4.800	-3.140		
Min_DN	-18.140	-20.050		
Cpk	2.639	2.619		
LSL(min)	-39	-39	-39	-39
USL(min)	39	39	39	39

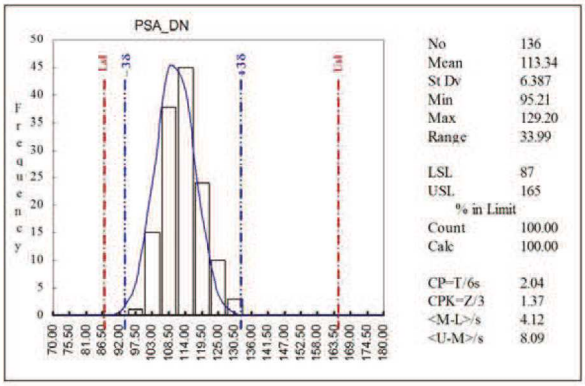




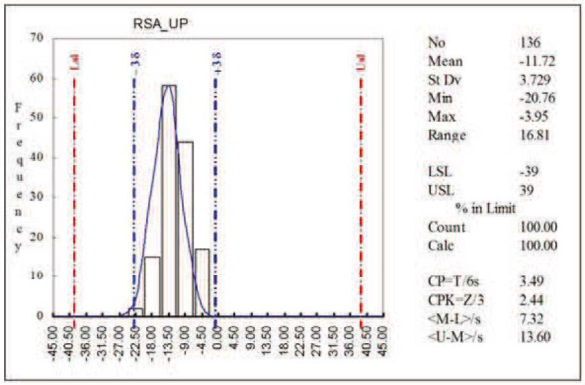
OBA RESULT – Grenada OBA PSA/RSA Dist.

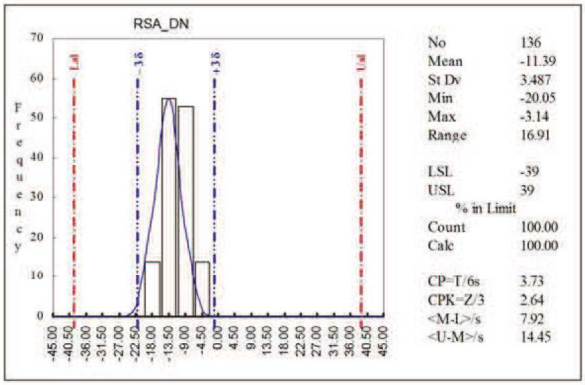
PSA





RSA





ORT – Cleanliness
→ Seagate Method [HGA]

ORT DATA SUMMARY – Seagate Method [HGA]

Using Seagate Method, HGA ORT Cleanliness (IC, LPC, NVR-FTIR, and DHS-Outgassing), Grenada passed specification.

Seagate Method	Sample Build	IC														
		F	Cl	NO2	Br	NO3	PO4	SO4	Total	Li	Na	NH4	K	Mg	Ca	Total
Program	Spec	0.02 ug/cm²	0.07 ug/cm²	0.05 ug/cm²	0.02 ug/cm²	NA	0.05 ug/cm²	0.3 ug/cm²	0.35 ug/cm²	NA	0.4 ug/cm²	0.2 ug/cm²	0.5 ug/cm²	0.15 ug/cm²	0.10 ug/cm²	0.70 ug/cm²
Grenada		ND	0.001	<0.001	ND	ND	ND	0.012	0.013	ND	ND	0.001	ND	ND	ND	0.001

Seagate Method	Sample Buil	LPC-# of particles (cts/Sq.cm)			NVR/FTIR - ug/cm²			DHS Outgassing - ng/part
		0.3um	0.5um	2.0un	NVR	FTIR		Total
Program	Spec->	Seagate spec is 50k for 0.3 (Note: Only dip the head)			NA	Silicone Oil< or =0.02	Hydrocarbon	<2500
Grenada		7104	1988	25	0.89	ND	0.017	121.6

ORT DATA SUMMARY – Seagate Method [HGA]

Using Seagate Method, HGA Seatape Grenada passed specification.

HPA	Total	Al/Mg/O	Al/O	Al/Ti/O	Si carbide /nitrite	Ti C/B/N	Ti/O	W/C	Cr/O	Zr/O
	0	0	0	0	0	0	0	0	0	0

Semi-hard	Total	Ni/P	Ni base	Fe/Cr(SST 400s)	Fe/Cr/Ni(SST 300s)	Fe base
	0.2	0	0	0	0.2	0

Magnetic	Total	Magnetic : Nd	Magnetic : Nd/Fe	Magnetic : Sm	Magnetic : Sm/Co
	0	0	0	0	0

Other	Total	Al/Si/O	Nb	Silver	Sn	Sn/Pb solder	talc	Al/Ni/O	Cu/Zn brass
	0.2	0	0	0	0	0	0.2	0	0
		sulphur base	Ca base	Na base	K base	Zn	Cu base	Cl base	Anodised Al
		0	0	0	0	0	0	0	0

ORT DATA SUMMARY – Seagate Method [HGA]

Using Seagate Method, HGA LPC-HPA Grenada passed specification.

Hard Particles	Total	AlMgO	AlO	AlOTiC	CrO	NbB	SiC	SiO	TiB	TiC	TiO	TiSn	TiV	WC	ZrC	ZrO
	3.00		3.00													

Magnetic Particles	Total	Nd based	Sm based	Sr based
	0.00			

SST Particles	Total	SST300s	SST400s
	2.00	2.00	

Metal Particles	Total	Ag based	Al based	Au based	Ca based	Cu based	Fe based	FeO	AlFeO
	7.00		5.00	2.00					
		MnCrS	Ni based	NiP	Pt based	Pb based	Sn based	SnPb	Zn based

Other Particles	Total	AlNiO	AlSiO	Cl based	FeMgSiO	MgCaO	MgSiO	Mixed Silicates	S based
	1.00			1.00					

→Reliability
HGA Grenada

RELIABILITY – HGA Grenada Summary

Grenada HGA Reliability Qualification

Item	Requiremnt	Method	Criteria	Sample size	Results
1	Thermal shock=> 30 mins @ -40°C, 30 mins @ 125°C 100/300/500 cycles	MRR/MWR check	D-MRR<5% D-MWR<1 ohm	50 sets	Passed
		200x Visual check	no crack/delam	50 sets	Passed
		SBB SEM	no crack/delam	10 sets	Passed
		SBB X-section and SEM	no crack/delam	10 sets	Passed
		SBB shear strength	Pass spec	10 sets per cycle stop	Passed
		Potting shear strength	Pass spec	10 sets per cycle stop	Passed
2	Chamber- High temperature and humidity =>85°C & 85% RH 100/300/500 hours	200x Visual check, Pole area-1500x corrosion	no crack/delam, no corrosion	50 sets	Passed
		QST MRR/Amp check	D-MRR<5% D-Amp<20%	50 sets	Passed
		MRR/MWR check	D-MRR<5% D-MWR<1 ohm	50 sets	Passed
		SBB SEM	no crack/delam	10 sets	Passed
		SBB X-section and SEM	no crack/delam	10 sets	Passed
		SBB shear strength	Pass spec	10 sets per hours stop	Passed
		Potting shear strength	Pass spec	10 sets per hours stop	Passed
3	10x AQ wash	200x Visual check	no crack/delam	50 sets	Passed
		MRR/MWR check	D-MRR<5% D-MWR<1 ohm	50 sets	Passed

RELIABILITY – HGA Grenada

Thermal Shock Test: MRR/MWR

Thermal shock	Before reliability		After 100cycles		After 300cycles		After 500cycles		Detla	
	MRR	MWR	MRR	MWR	MRR	MWR	MRR	MWR	MRR	MWR
Mean	289.15	7.19	287.84	7.37	290.32	7.37	289.10	7.37	0.02%	-0.025
Sigma	31.52	0.21	29.82	0.22	32.45	0.21	31.58	0.22	0.00	-0.03
Max	366.30	7.70	373.20	7.90	362.90	7.90	359.20	7.90	1.94%	-0.026
Min	220.30	6.50	218.90	6.60	222.20	6.70	216.40	6.70	1.77%	-0.031
Disposition									Passed	Passed

Spec: Delta MRR < 5%, Delta MWR <0.5ohm

All samples PASSED

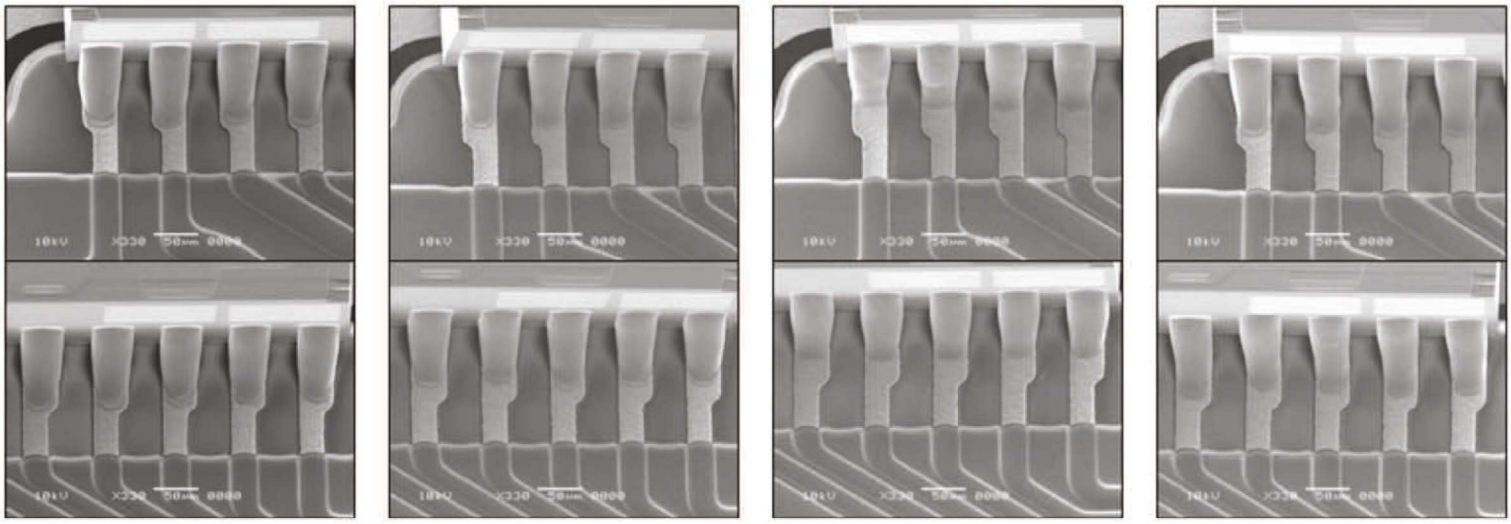
Thermal Shock Test: 200x Visual

No crack, no delam, no abnormal, PASSED

RELIABILITY – HGA Grenada

Thermal Shock Test: SBB SEM

No crack, no delam, no abnormal, PASSED



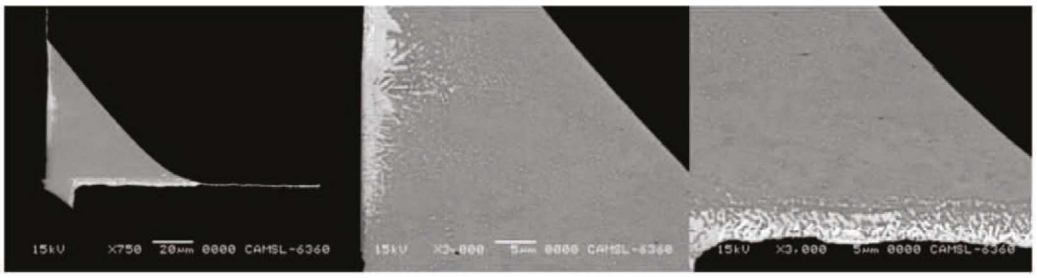
[redacted]

RELIABILITY – HGA Grenada

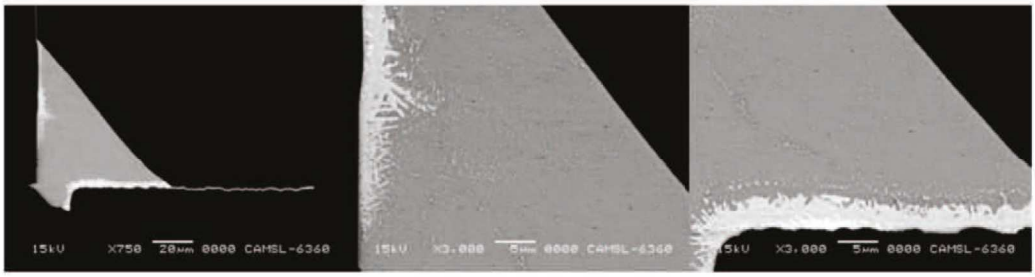
Thermal Shock Test: X-section and SEM

No crack, no delam, no abnormal, PASSED

Before thermal shock



After thermal shock



RELIABILITY – HGA Grenada

Thermal Shock Test: SBB Shear Strength

Thermal shock	[redacted]											
	Pad2	Pad7	A&B mode%	Pad2	Pad7	A&B mode%	Pad2	Pad7	A&B mode%	Pad2	Pad7	A&B mode%
Mean	57.65	56.75	100%	55.55	54.55	100%	53.8	54.15	100%	52.6	54.6	100%
Sigma	8.83	8.70		8.77	8.25		6.72	7.45		7.85	8.61	
Max	71	72		69	71		65	71		64	79	
Min	43	45		44	42		38	43		37	43	

No sample fail in SBB shear strength test and all can meet SBB spec; Passed

Spec: Minimum 20

All samples PASSED

RELIABILITY – HGA Grenada

Thermal Shock Test: Potting Shear Strength

Thermal shock	[redacted]											
	Pad2	Pad5	A&B mode%	Pad2	Pad5	A&B mode%	Pad2	Pad5	A&B mode%	Pad2	Pad5	A&B mode%
Mean	290	288.3	100%	287.8	286.55	100%	281.8	280.85	100%	276.1	273.05	100%
Sigma	35.25	35.99		37.41	59.52		36.39	51.02		48.70	39.05	
Max	355	380		364	391		388	411		368	352	
Min	208	230		216	187		208	190		193	162	

No sample fail in Potting shear strength test and all can meet Potting spec; Passed

Spec: Minimum 100

All samples PASSED

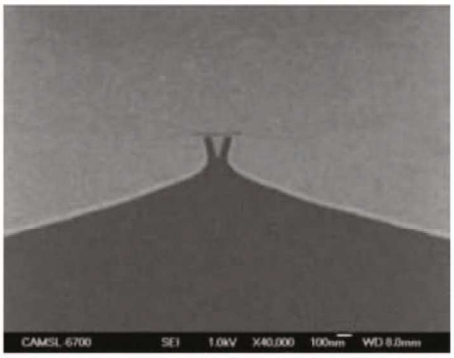
RELIABILITY – HGA Grenada

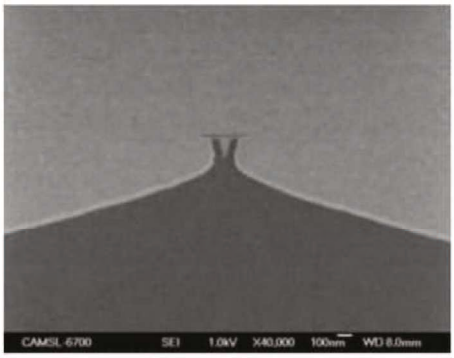
[redacted]

No crack, no delam, no abnormal, PASSED

No pole corrosion, PASSED

[redacted]





RELIABILITY – HGA Grenada

[redacted]

[redacted]

Chamber	[redacted]								Delta	
	MRR	Amp	MRR	Amp	MRR	Amp	MRR	Amp	MRR	Amp
Mean	293.58	8807.89	294.59	8710.54	295.54	8762.27	291.44	8642.33	0.73%	1.9%
Sigma	44.08	2609.04	44.15	2720.01	43.80	2557.35	44.87	2718.97	-1.80%	-4.2%
Max	424.8	18075.7	429.6	18999.7	426.5	20392.3	433.8	18417.1	-2.13%	-1.9%
Min	205.4	4079.5	201.4	3857.4	206.5	3762.4	203.8	3870.3	0.77%	5.1%
Disposition									Passed	Passed

Spec: Delta MRR <5%, Delta Amplitude <20%

All samples PASSED

RELIABILITY – HGA Grenada

Chamber Test: MRR/MWR

MR-R/MWR

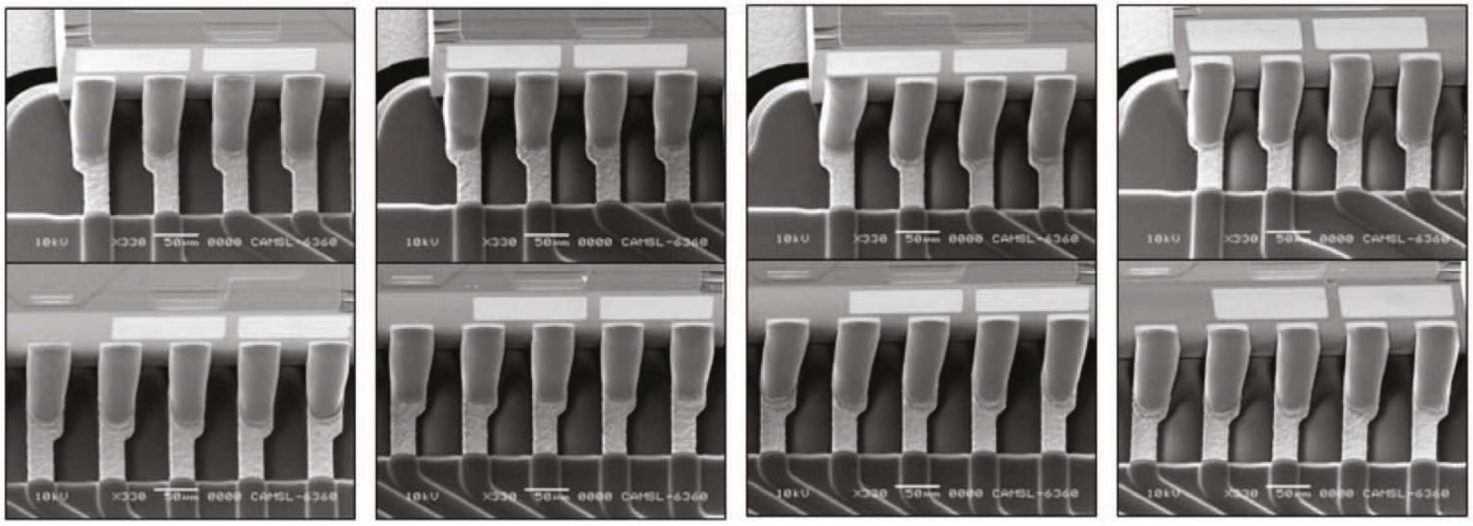
Chamber	[redacted]								Delta	
	MRR	MWR	MRR	MWR	MRR	MWR	MRR	MWR	MRR	MWR
Mean	301.867	7.201	301.318	7.38	302.152	7.365	299.811	7.382	0.68%	-0.025
Sigma	30.434	0.177	31.591	0.186	29.917	0.186	31.052	0.178	-0.02	-0.01
Max	380.3	7.6	381.9	7.8	371.2	7.8	376.5	7.8	1.00%	-0.026
Min	233	6.8	227.6	7	239.4	6.9	228.3	7	2.02%	-0.029
Disposition									Passed	Passed

Spec: Delta MRR ±5%, Delta MWR <0.5ohm

All samples PASSED

RELIABILITY – HGA Grenada

[redacted] → No crack, no delam, no abnormal, PASSED



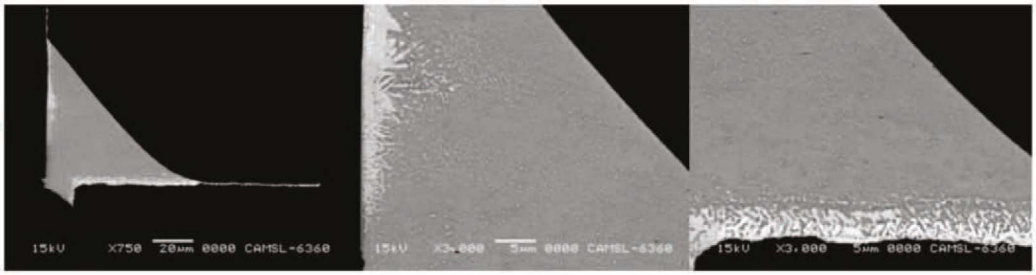
[redacted]

RELIABILITY – HGA Grenada

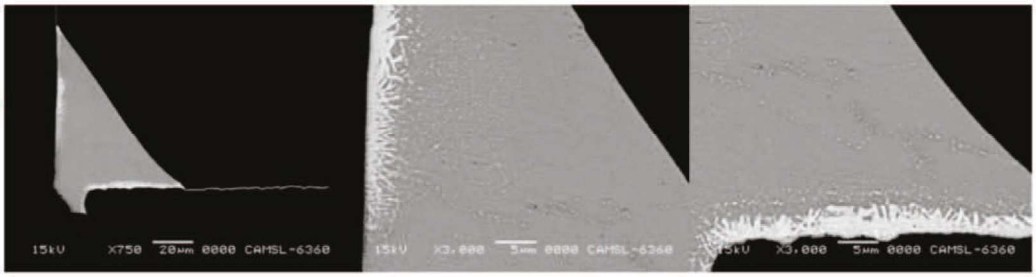
Chamber Test: X-section and SEM

No crack, no delam, no abnormal, PASSED

Before chamber test



After chamber test



RELIABILITY – HGA Grenada

Chamber Test: SBB Shear Strength

SBB Shear Strength-Chamber

Chamber	Normal			[redacted]								
	Pad2	Pad7	A&B mode%	Pad2	Pad7	A&B mode%	Pad2	Pad7	A&B mode%	Pad2	Pad7	A&B mode%
Mean	57.05	58.05	100%	55.80	54.75	100%	53.10	53.55	100%	54.85	53.25	100%
Sigma	8.74	9.02		8.44	8.12		8.01	8.22		8.63	7.59	
Max	74.00	71.00		71.00	70.00		65.00	72.00		72.00	66.00	
Min	42.00	45.00		37.00	44.00		37.00	40.00		43.00	41.00	

No sample fail in SBB shear strength test and all can meet SBB spec; Passed

Spec: Minimum 20

All samples PASSED

RELIABILITY – HGA Grenada

Chamber test: Potting Shear Strength

Chamber	Normal			[redacted]								
	UP	DN	A&B mode%	UP	DN	A&B mode%	UP	DN	A&B mode%	UP	DN	A&B mode%
Mean	291.25	294.05	100%	285.85	287.05	100%	283.00	280.25	100%	273.65	273.95	100%
Sigma	44.16	33.61		45.38	40.59		30.66	42.49		49.51	41.88	
Max	377.00	357.00		378.00	364.00		344.00	352.00		354.00	379.00	
Min	204.00	217.00		210.00	222.00		216.00	198.00		178.00	208.00	

No sample fail in Potting shear strength test and all can meet Potting spec; Passed

Spec: Minimum 100

All samples PASSED

RELIABILITY – HGA Grenada

[redacted]

No crack, no delam, no abnormal, PASSED

[redacted]

[redacted]	Before reliability		After reliability		Delta	
	MRR	MWR	MRR	MWR	MRR	MWR
Mean	304.566	7.2001	303.485	7.3787	0.35%	-0.025
Sigma	29.943	0.211	30.740	0.206	-2.66%	0.020
Max	376.4	7.76	373.7	7.94	0.72%	-0.023
Min	199.1	6.76	203.4	6.95	-2.16%	-0.028
Disposition					Passed	Passed

Spec: Delta MRR < 5%, Delta MWR <0.5ohm

All samples PASSED

→Reliability
Slider Grenada

RELIABILITY – Slider Summary

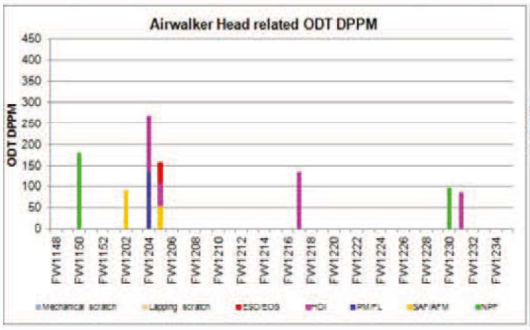
Seagate program - Grenada slider reliability qualification summary

Item	Requirement	method	Criteria	Sample si	Results: Reject	Disposition
1	[redacted]	A - Serious type	< 5%	20pcs	0%	Passed
		B - Slight type	< 20%		0%	Passed
		C - Scratch	< 2%		0%	Passed
		D - Pinhole	< 30%		0%	Passed
2		Corroson %	No corrosion under 1500x	20pcs	0%	Passed
		MRR shift rate %	< 5%		0%	Passed
		MFPP Drop rate %	< 20%		0%	Passed

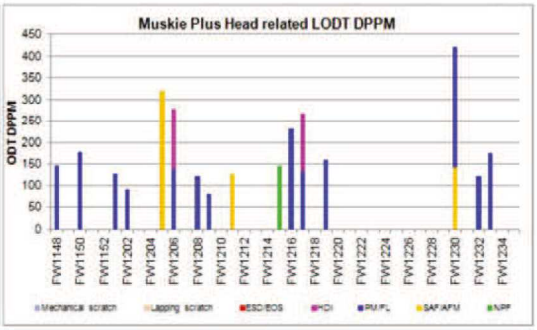
Slider reliability is passed

Slider Chamber	Before reliability		After reliability		Delta	
	MRR	MFPP	MRR	MFPP	MRR	MFPP
Mean	266.0	9263.6	266.0	9245.6	0.02%	-0.002
Sigma	36.2	3342.7	37.0	3344.0	2.11%	0.005
Max	360.1	18507.0	359.3	18551.4	3.99%	0.006
Min	176.5	3796.9	178.2	3783.5	-3.94%	-0.012
Disposition					Passed	Passed

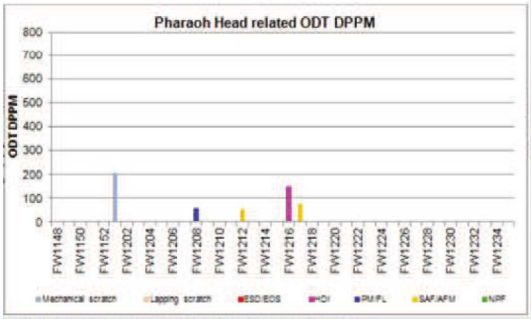
AFA Korat Head FA Pareto – TK ODT Head related



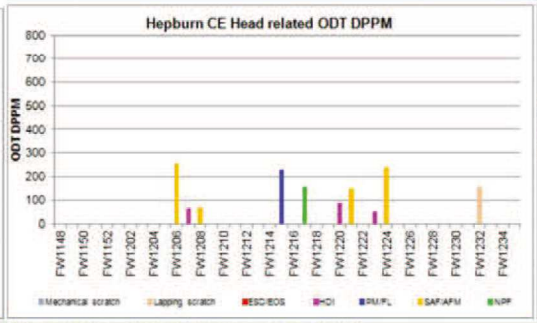
FW1217 – 134 DPPM (1x) ; smearing contamination
FW1230 – 95 DPPM (1x) ; NPF
FW1231 – 85 DPPM (1x) ; HDI



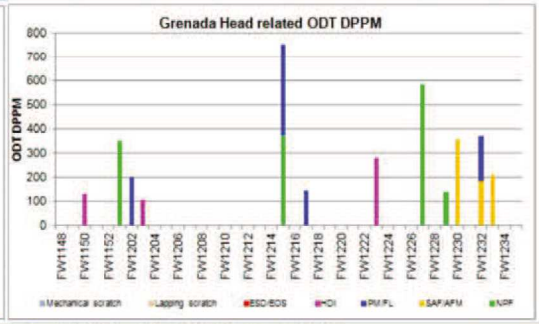
FW1217 – 267 DPPM (2x) ; KAG and HDI
FW1219 – 160 DPPM (1x) ; KAG
FW1230 – 422 DPPM (3x) ; KAG (2x), transverse hysteresis (1x)
FW1232 – 122 DPPM (1x) ; Asymmetry
FW1233 – 175 DPPM (1x) ; Asymmetry



FW1212 – 53 DPPM (1x) ; SAF/AFM
FW1216 – 150 DPPM (2x) ; HDI
FW1217 – 79 DPPM (1x) ; SAF/AFM

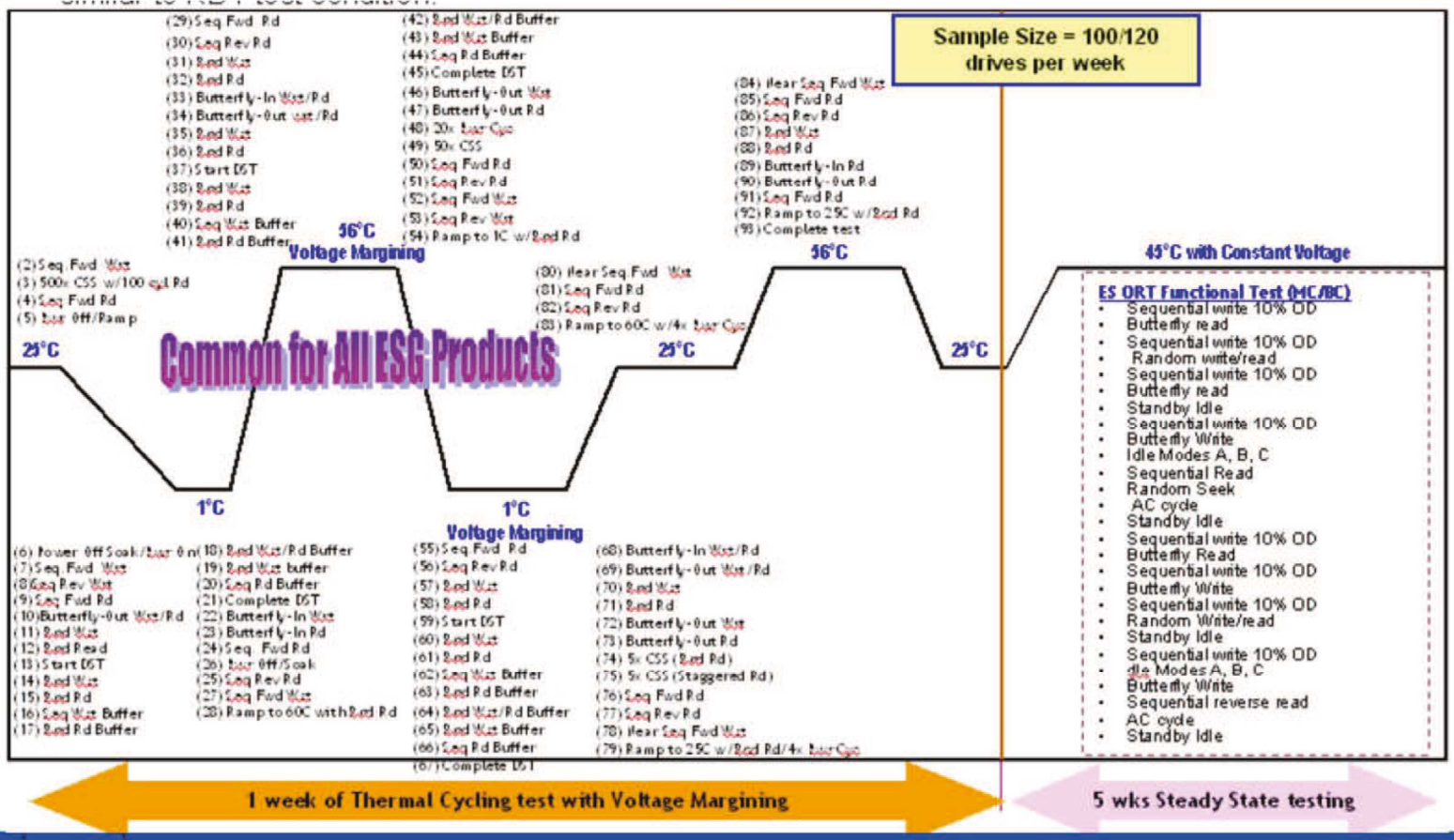


FW1221 – 150 DPPM (2x) ; SAF/AFM
FW1223 – 55 DPPM (1x) ; HDI
FW1224 – 242 DPPM (1x) ; SAF/AFM
FW1232 – 160 DPPM (1x) ; Lapping scratch



FW1227 – 584 DPPM (1x) ; NPF
FW1229 – 138 DPPM (1x) ; NPF
FW1230 – 355 DPPM (3x) ; SAF/AFM
FW1232 – 368 DPPM (2x) ; (1x)PM/FL, (1x) SAF/AFM
FW1233 – 212 DPPM (1x) ; SAF/AFM

[redacted]



DVT Test	Metrics	Stressors	Failure Root Cause
ISI Transverse Field Stress *	Kink / KAG, SMAN	Field	PM/FL, SAF (polarity)
ISI Cross Track Field Stress *	Amplitude, ASY, Kink, SMAN	Field	Shield, PM
ISI Heater Stress *	Amp, Asy, SMAN, FDG, Bark_Jump, polarity reversal	Thermal	SAF/AFM
ISI ESD Stress / CDM	Res, Amp, Popcorn, SNR	ESD	Barrier, SAF/AFM
ISI HGA High Field *	Pinning strength, TC hump, Shield and SAF saturation field, PM switching	Stray field, Super high field	Shield, SAF/AFM, PM
ISI Corrosion DVT	Res, Amp, Asy, SMAN, Polarity	Chemical corrosion	AFM, PM, stack
Vermit HGA Life DVT	Res, Amplitude	Voltage + temp + time	Barrier
Spin-stand Stray Field	Res, Amplitude, Asy, noise	Stray field	Shield
Spin-stand MIED DVT	Resistance, Amplitude, Asy, noise	Mechanic stress + temp + time	SAF (polarity)

DVT Test	Stressors & Levels	Sample Size
ISI Transverse Field Stress	Field, 3,5kOe, 1.5T	10 bars/wafer x 2 wafers
ISI Cross Track Field Stress	Field, -500Oe	10 bars/wafer x 2 wafers
ISI Heater Stress	Temp, 100 – 200C (heater power 20 mw – 80mW)	10 bars/wafer x 2 wafers
ISI ESD Stress / CDM	Voltage stress	10 bars/wafer x 2 wafers
ISI Corrosion DVT	Chemical corrosion	10 bars/wafer x 2 wafers
ISI HGA High Field	transverse & x-track 15kOe, 3,5kOe TCs and 200-500Oe stray fields	20 HGA/wafer x 2 wafers (ET passers)
Vermit HGA Life DVT	Voltage (200-350mv) + 85C + 400 hours	128 HGAs (ET sort 6 and up)
Spin-stand Stray Field	Stray fields 0-500Oe	20 HGA/wafer x 2 wafers
Spin-stand MIED DVT	L/UL + interference	50 HGA/wafer x 2 wafers